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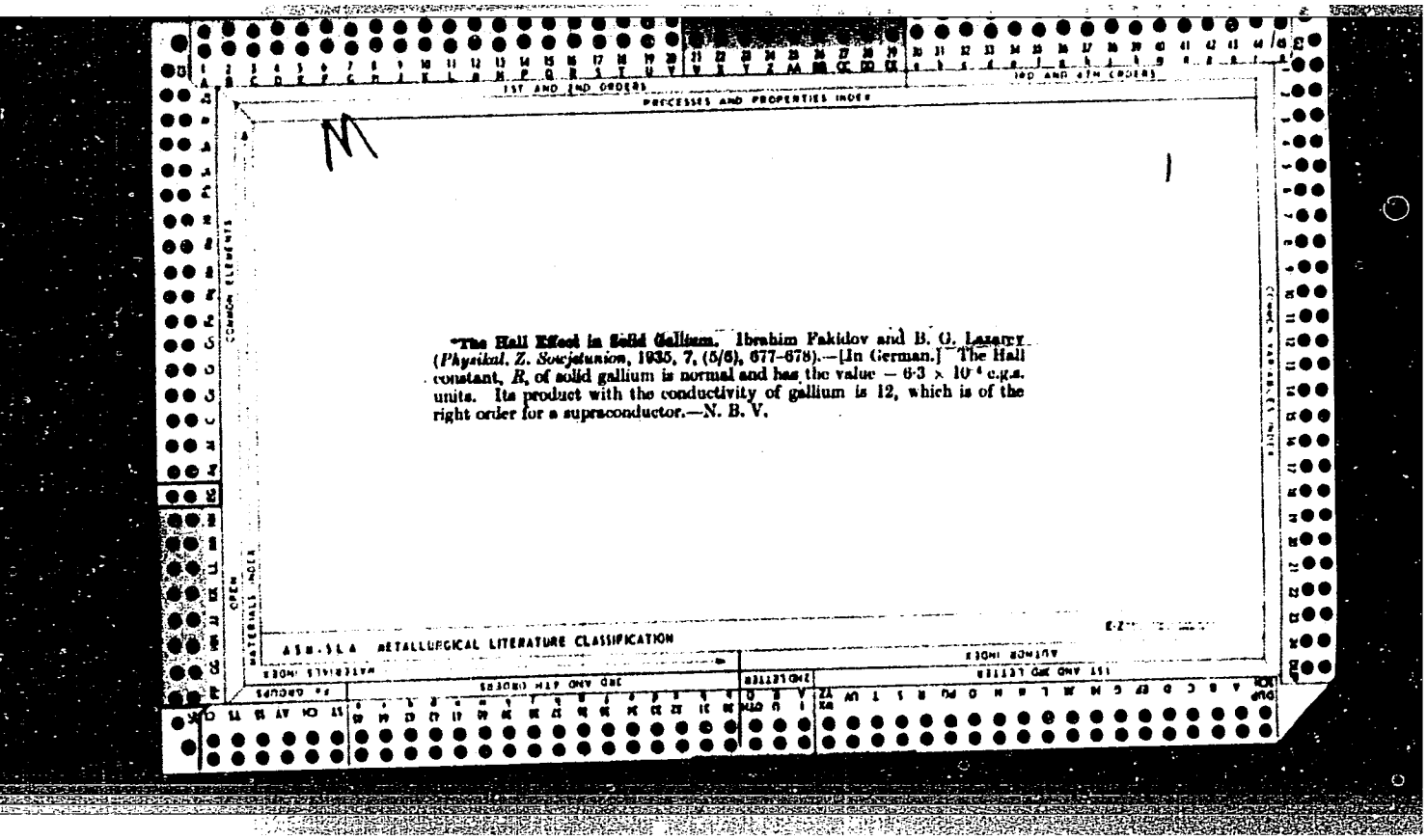

"The Hall Effect in Solid Gallium." Ibrahim Fakidov and B. G. Lazarev. (*Physikal. Z. Sowjetunion*, 1935, 7, (5/6), 677–678).—[In German.] The Hall constant, R, of solid gallium is normal and has the value $-6{\cdot}3 \times 10^{-4}$ c.g.s. units. Its product with the conductivity of gallium is 12, which is of the right order for a superconductor.—N. B. V.

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LASAREW, B. G.

On the Magnetic Susceptibility of Metallic Cerium and Praseodymium. L. F. Wereschagin, L. W. Schubnikow, and B. G. Lasarew (Physikal. Z. Sowjetunion, 1936, 10, (5), 618-624). --(In German) Values of the magnetic susceptibilities, χ, of cerium and praseodymium were determined at temperatures between about 15° and 296° abs. The results show that, contrary to the conclusion of Janus and Dronin (Sowjet. Phys., 1936, 9, 72) the value of χ for cerium does not obey the Curie-Weiss law. At low temperatures, the curve connecting $1/\chi$ with T for cerium departs increasingly from that corresponding to the Curie law, as the temperature is reduced. No marked hysteresis was shown by cerium at 103°-200° abs. as found by Trombe (Compt. rend., 1934, 198, 1591). Values of χ for praseodymium obey the Curie-Weiss law, and give the value of $\Theta = -6°$.--J.S.G.T.

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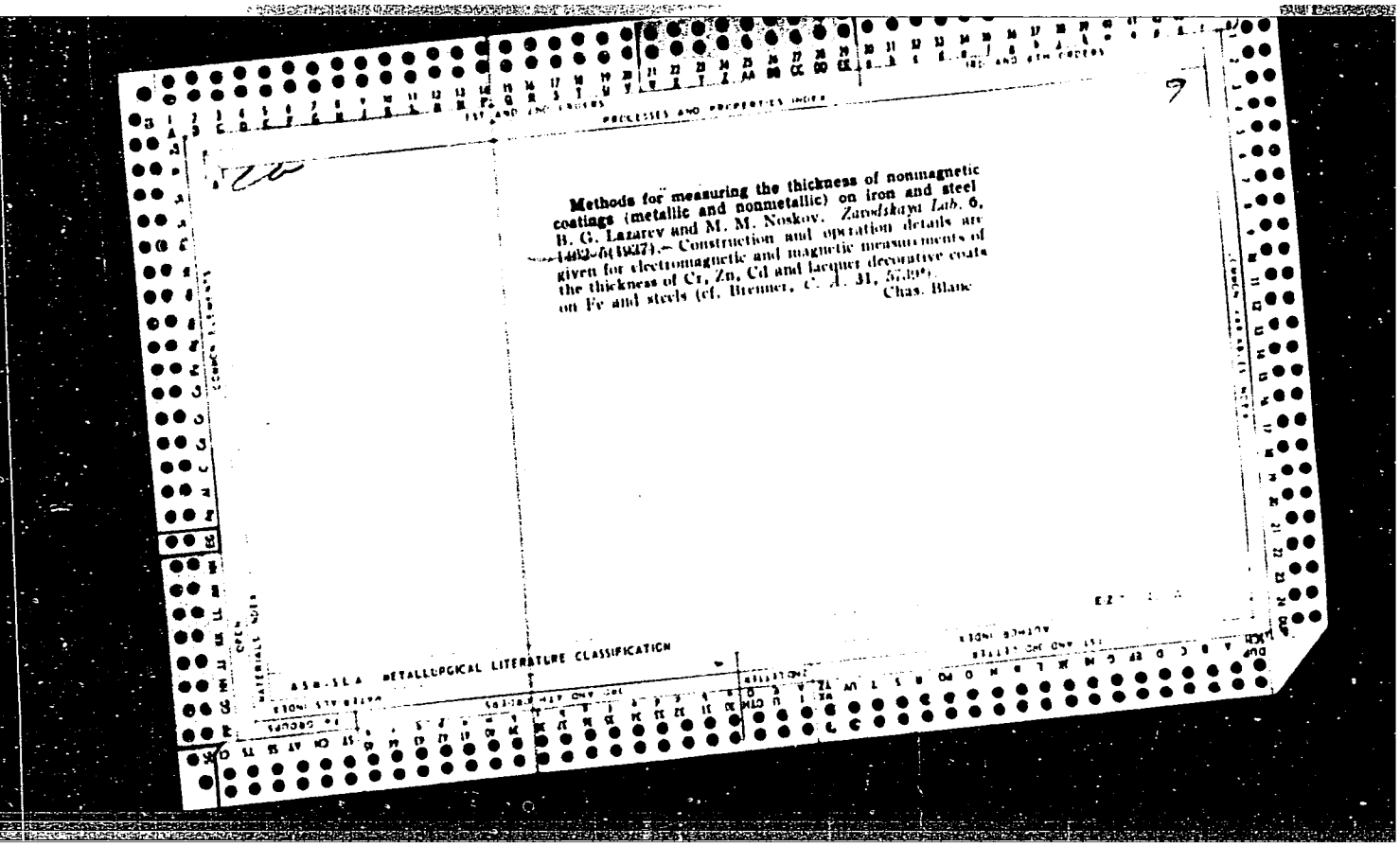

Methods for measuring the thickness of nonmagnetic coatings (metallic and nonmetallic) on iron and steel. B. G. Lazarev and M. M. Noskov. *Zavodskaya Lab.* 6, 1413–6 (1937).—Construction and operation details are given for electromagnetic and magnetic measurements of the thickness of Cr, Zn, Cd and lacquer decorative coats on Fe and steels (cf. Brenner, C. A. 31, 5780).
Chas. Blanc

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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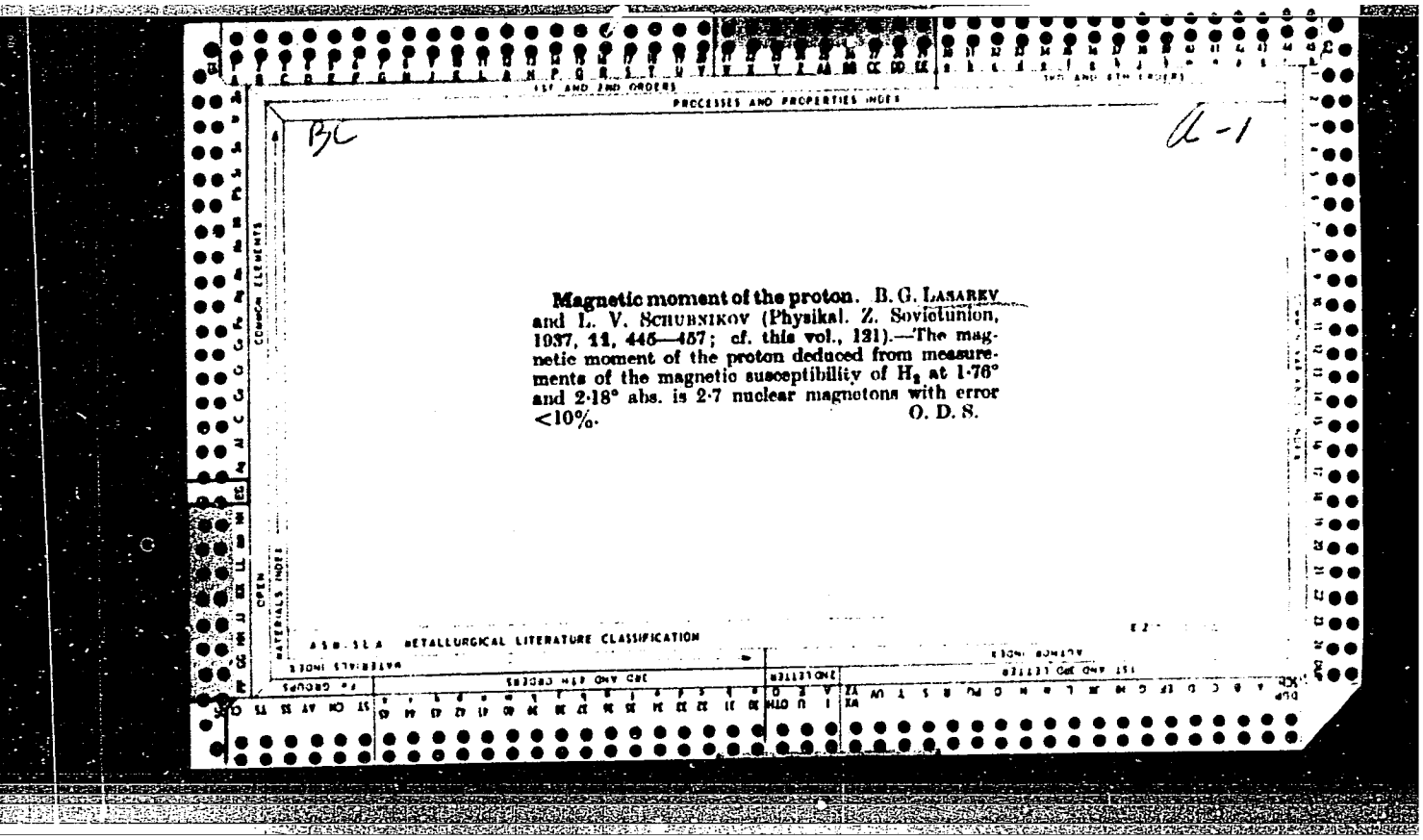

BC

A-1

Magnetic moment of the proton. B. G. LASAREV and L. V. SCHUBNIKOV (Physikal. Z. Sovietunion, 1937, **11**, 445—457; cf. this vol., 121).—The magnetic moment of the proton deduced from measurements of the magnetic susceptibility of H_2 at 1·76° and 2·18° abs. is 2·7 nuclear magnetons with error <10%. O. D. S.

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B. G., NOSKOV, M. M.

Change of Electromesistance of Zinc and Cadmium Monocrystals in a Magnetic Field. Sow. Phys. 13, 130, 1938.

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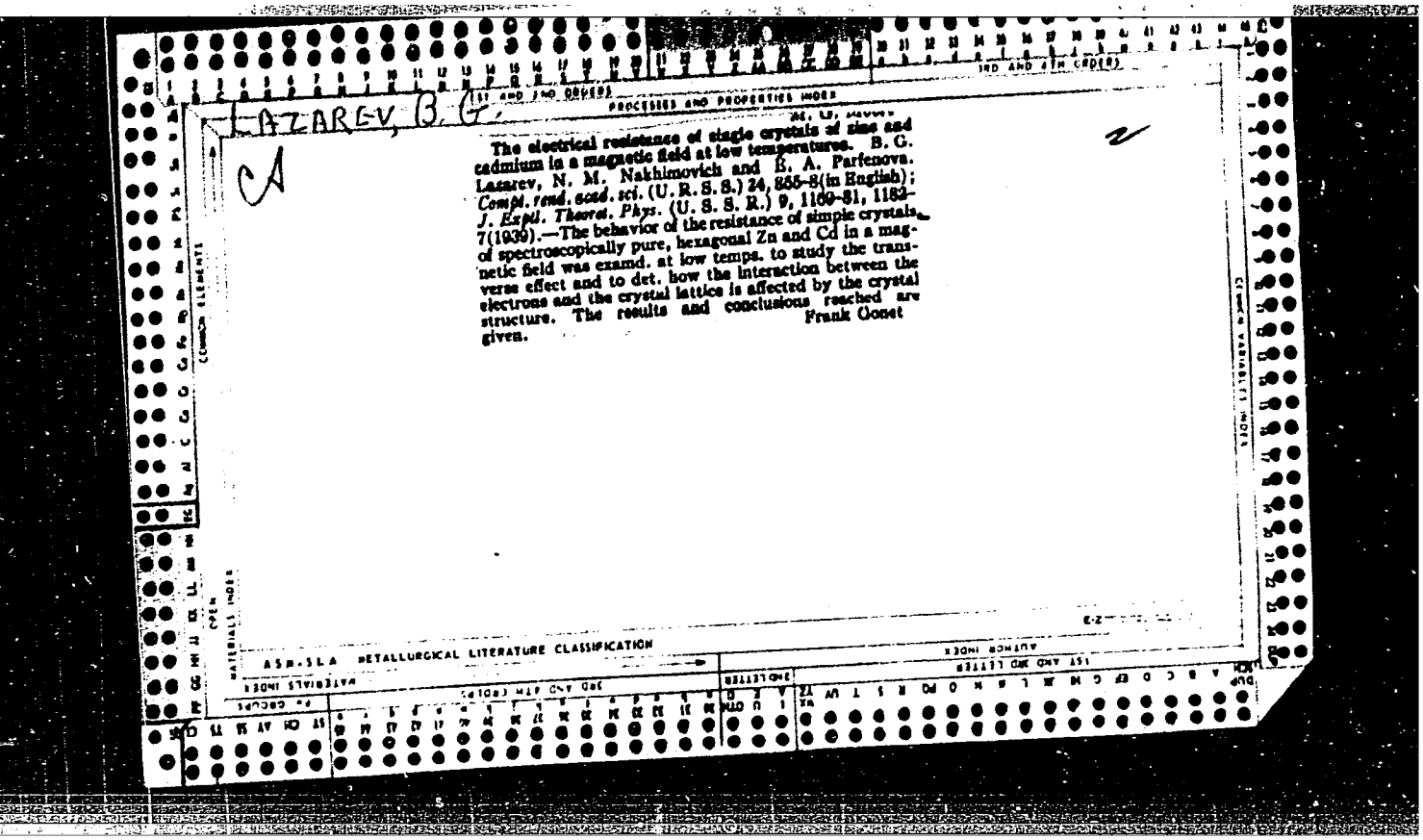

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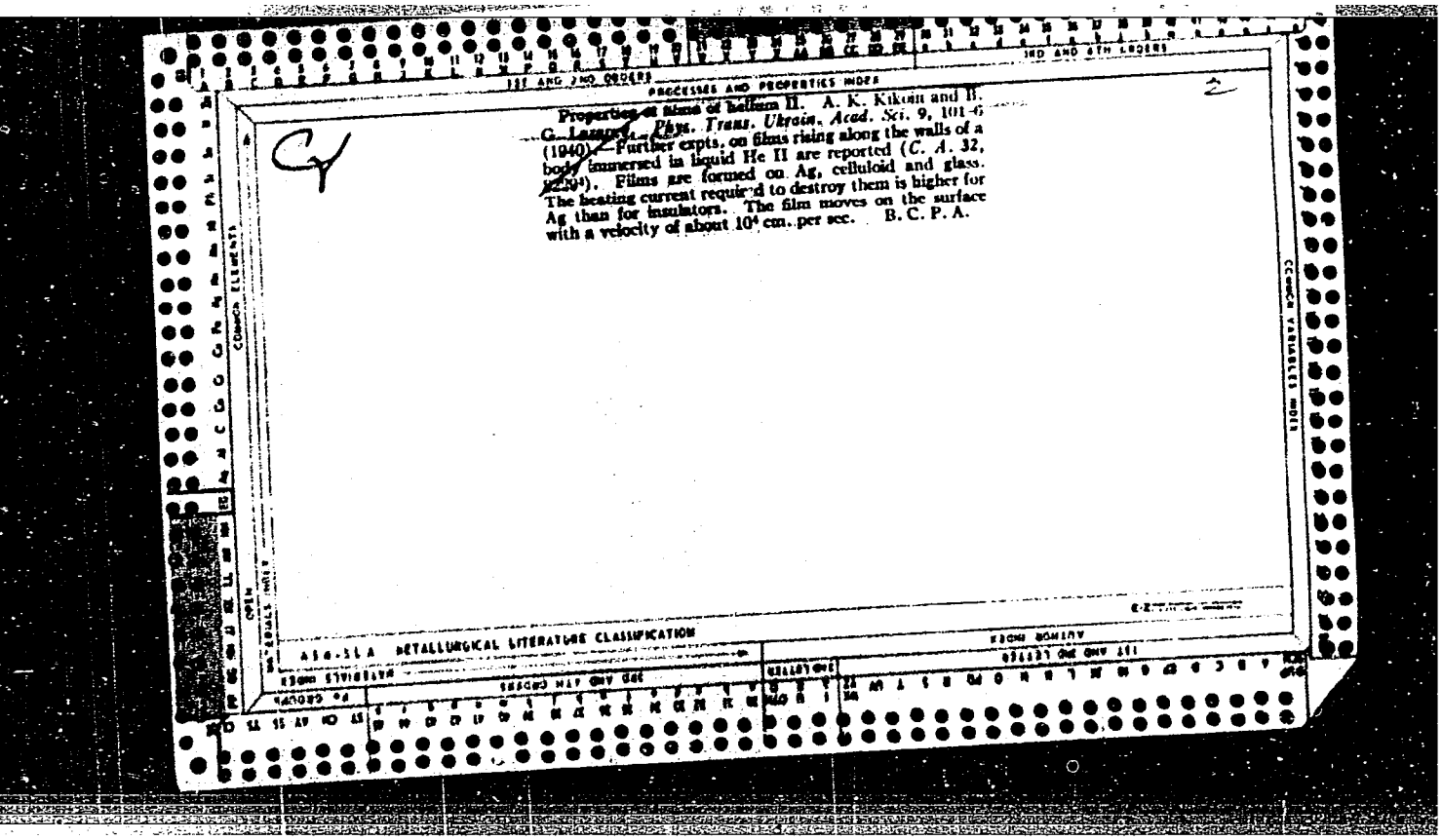

PROCESSES AND PROPERTIES INDEX

Properties of films of helium II. A. K. Kikoin and B. G. Lasarew. *Phys. Trans. Ukrain. Acad. Sci.* 9, 101-6 (1940). Further expts. on films rising along the walls of a body immersed in liquid He II are reported (*C. A.* 32, 8239⁴). Films are formed on Ag, celluloid and glass. The heating current required to destroy them is higher for Ag than for insulators. The film moves on the surface with a velocity of about 10^4 cm. per sec. B. C. P. A.

A10-31A METALLURGICAL LITERATURE CLASSIFICATION

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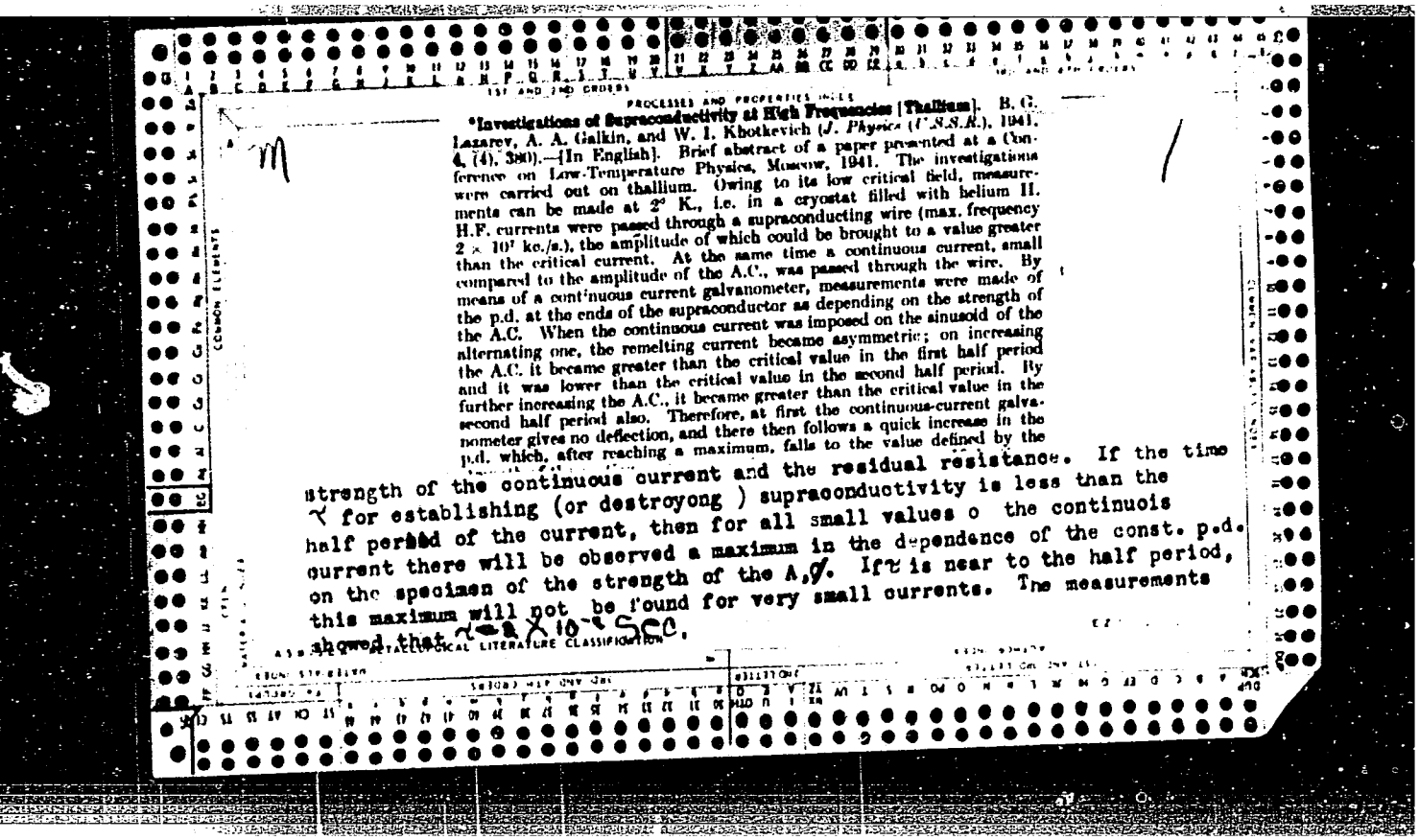

PROCESSES AND PROPERTIES INDEX

***Investigations of Superconductivity at High Frequencies [Thallium].** B. G. Lazarev, A. A. Galkin, and W. I. Khotkevich (*J. Physics* (*U.S.S.R.*), 1941, 4, (4), 380).—[In English]. Brief abstract of a paper presented at a Conference on Low-Temperature Physics, Moscow, 1941. The investigations were carried out on thallium. Owing to its low critical field, measurements can be made at 2° K., i.e. in a cryostat filled with helium II. H.F. currents were passed through a superconducting wire (max. frequency 2×10^7 kc./s.), the amplitude of which could be brought to a value greater than the critical current. At the same time a continuous current, small compared to the amplitude of the A.C., was passed through the wire. By means of a continuous current galvanometer, measurements were made of the p.d. at the ends of the superconductor as depending on the strength of the A.C. When the continuous current was imposed on the sinusoid of the alternating one, the remelting current became asymmetric; on increasing the A.C. it became greater than the critical value in the first half period and it was lower than the critical value in the second half period. By further increasing the A.C., it became greater than the critical value in the second half period also. Therefore, at first the continuous-current galvanometer gives no deflection, and there then follows a quick increase in the p.d. which, after reaching a maximum, falls to the value defined by the

strength of the continuous current and the residual resistance. If the time τ for establishing (or destroyong) supraconductivity is less than the half period of the current, then for all small values o the continuois current there will be observed a maximum in the dependence of the const. p.d. on the specimen of the strength of the A.C. If τ is near to the half period, this maximum will not be found for very small currents. The measurements showed that $\tau = 8 \times 10^{-6}$ sec.

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LAZAREV, B. G.

1119 537.312.62

The magnetic behaviour of supraconducting alloys of Sn-Zn. LAZAREV, B. G., AND NAKHUTIN, I. E. *J. Phys., U.S.S.R.*, 6, 3-4, *pp.* 116-119, 1942.—The critical fields and temperatures of the alloys coincide with those for Sn. Very small particles of Sn which could change the critical fields are not present in the alloys in any noticeable quantity. In low fields the curves for the magnetic moment of the investigated alloys, and even of the alloy containing 10% of Sn, do not differ from the curves for the pure supraconductor.

Physico-Tech. Inst., Acad. of Sci. of the Ukrainian SSR, Kharkov, c1941.

1119 537.312.62

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LAZAREV, B. G.

"Apparatus for Obtaining Temperatures Lower than 0.8°K," Zhur. Esper. i. Teoret. Fiz., 12, No 11-12, 1942.

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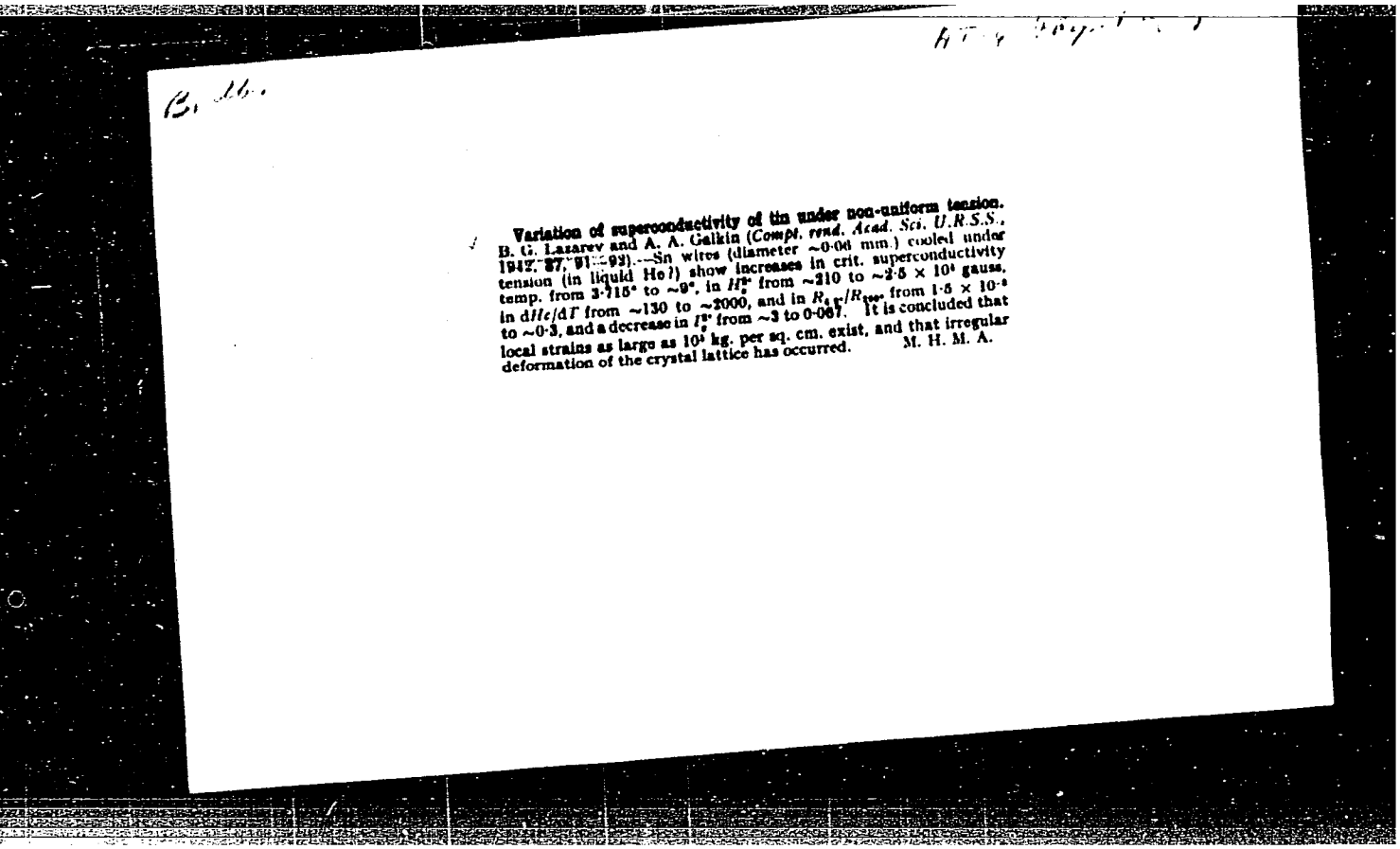

Variation of superconductivity of tin under non-uniform tension. B. G. Lazarev and A. A. Galkin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 91–93).—Sn wires (diameter ~0·06 mm.) cooled under tension (in liquid He?) show increases in crit. superconductivity temp. from 3·715° to ~9°, in H_0^* from ~210 to ~2·5 × 10⁴ gauss, in dH_c/dT from ~130 to ~2000, and in $R_{4.2°}/R_{273°}$ from 1·5 × 10⁻⁴ to ~0·3, and a decrease in I_0^* from ~3 to 0·067. It is concluded that local strains as large as 10⁵ kg. per sq. cm. exist, and that irregular deformation of the crystal lattice has occurred. M. H. M. A.

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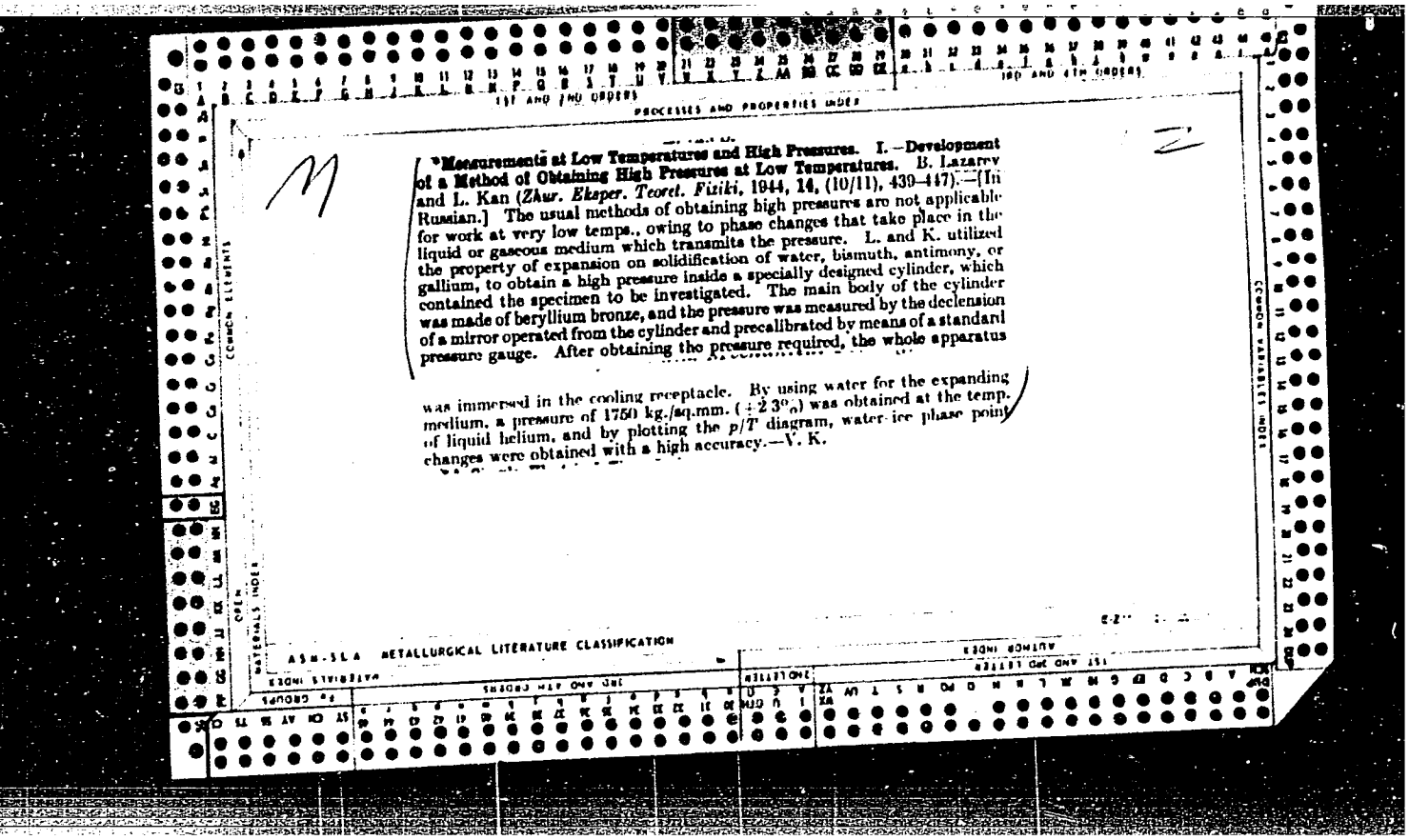

PROCESSES AND PROPERTIES INDEX

Measurements at Low Temperatures and High Pressures. I.—Development of a Method of Obtaining High Pressures at Low Temperatures. B. Lazarev and L. Kan (*Zhur. Eksper. Teoret. Fiziki*, 1944, **14**, (10/11), 439–447).—[In Russian.] The usual methods of obtaining high pressures are not applicable for work at very low temps., owing to phase changes that take place in the liquid or gaseous medium which transmits the pressure. L. and K. utilized the property of expansion on solidification of water, bismuth, antimony, or gallium, to obtain a high pressure inside a specially designed cylinder, which contained the specimen to be investigated. The main body of the cylinder was made of beryllium bronze, and the pressure was measured by the declension of a mirror operated from the cylinder and precalibrated by means of a standard pressure gauge. After obtaining the pressure required, the whole apparatus

was immersed in the cooling receptacle. By using water for the expanding medium, a pressure of 1750 kg./sq.mm. (±2.3%) was obtained at the temp. of liquid helium, and by plotting the p/T diagram, water-ice phase point changes were obtained with a high accuracy.—V. K.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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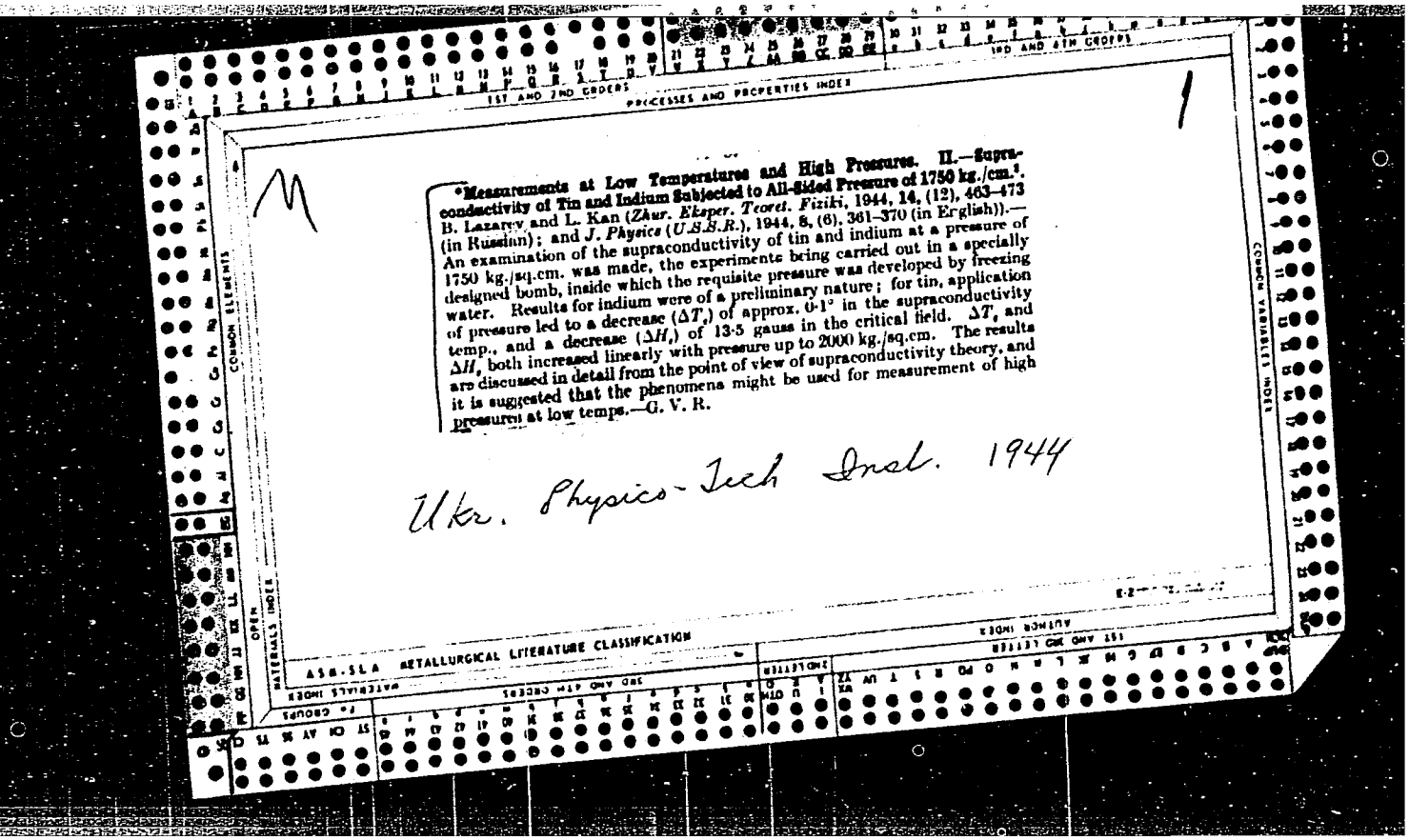

*Measurements at Low Temperatures and High Pressures. II.—Superconductivity of Tin and Indium Subjected to All-Sided Pressure of 1750 kg./cm.². B. Lazarev and L. Kan (*Zhur. Eksper. Teoret. Fiziki*, 1944, 14, (12), 463–473 (in Russian); and *J. Physics* (*U.S.S.R.*), 1944, 8, (6), 361–370 (in English)).—An examination of the supraconductivity of tin and indium at a pressure of 1750 kg./sq.cm. was made, the experiments being carried out in a specially designed bomb, inside which the requisite pressure was developed by freezing water. Results for indium were of a preliminary nature; for tin, application of pressure led to a decrease (ΔT_c) of approx. 0·1° in the supraconductivity temp., and a decrease (ΔH_c) of 13·5 gauss in the critical field. ΔT_c and ΔH_c both increased linearly with pressure up to 2000 kg./sq.cm. The results are discussed in detail from the point of view of supraconductivity theory, and it is suggested that the phenomena might be used for measurement of high pressures at low temps.—G. V. R.

Ukr. Physico-Tech Inst. 1944

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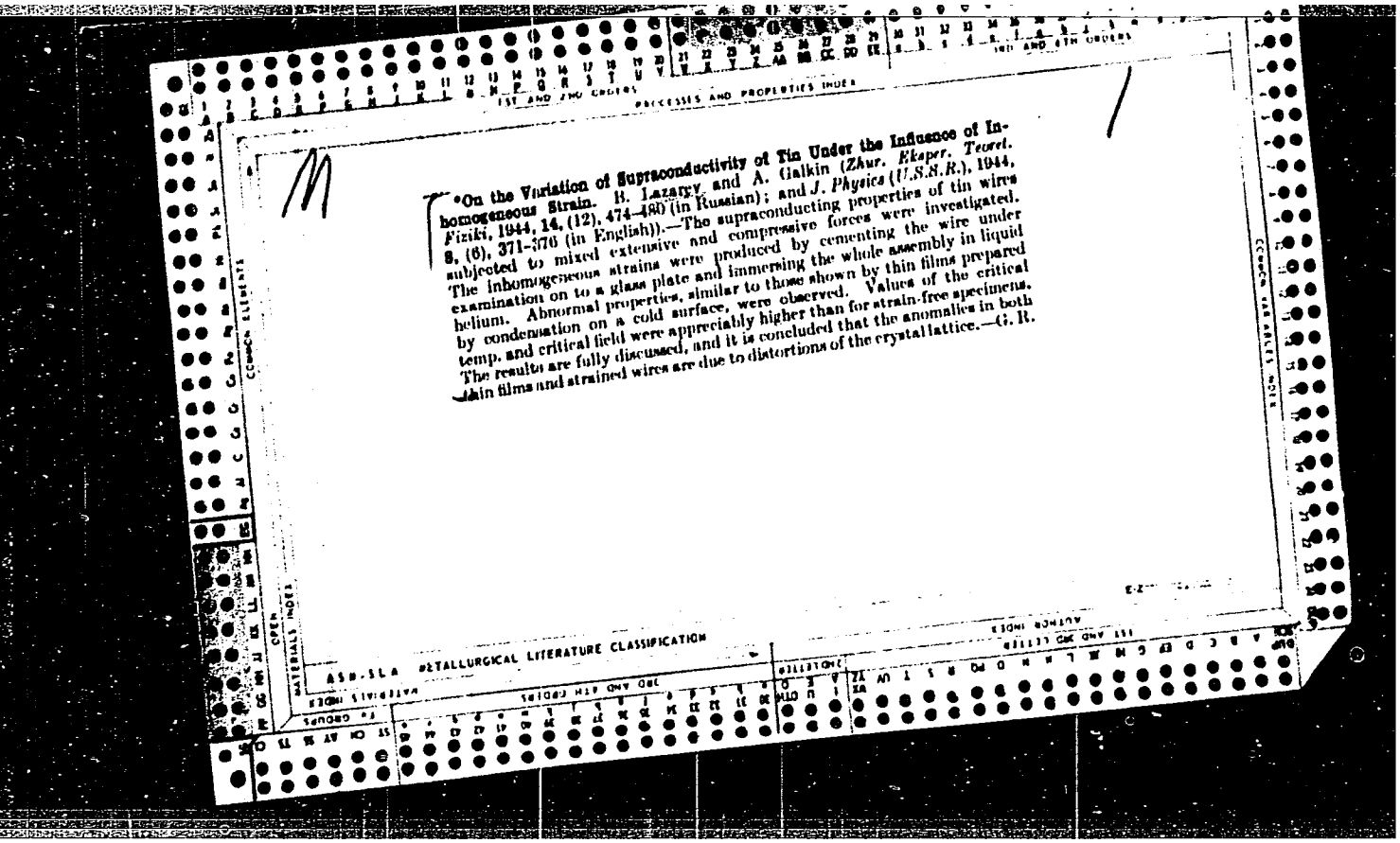

*On the Variation of Supraconductivity of Tin Under the Influence of Inhomogeneous Strain. B. Lazarev and A. Galkin (*Zhur. Eksper. Teoret. Fiziki*, 1944, 14, (12), 474–480 (in Russian); and *J. Physics (U.S.S.R.)*, 1944, 8, (6), 371–376 (in English)).—The supraconducting properties of tin wires subjected to mixed extensive and compressive forces were investigated. The inhomogeneous strains were produced by cementing the wire under examination on to a glass plate and immersing the whole assembly in liquid helium. Abnormal properties, similar to those shown by thin films prepared by condensation on a cold surface, were observed. Values of the critical temp. and critical field were appreciably higher than for strain-free specimens. The results are fully discussed, and it is concluded that the anomalies in both thin films and strained wires are due to distortions of the crystal lattice.—G. R.

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8T75

LAZAREV, B.G.

Mar 1947

USSR/Superconductivity
Wire - Electrical properties

"Some Experiments on Superconductivity at Radio Frequencies," B. G. Lazarev, A. A. Galkin, V. I. Khotkevich, 3 pp.

"CR Acad Sci" Vol LV, No 9.

Studies of tin and thallium wires 0.1 - 0.2 mm in diameter.

Physico-Tech. Inst. Acad. Sci., Kharkov, -1946-.

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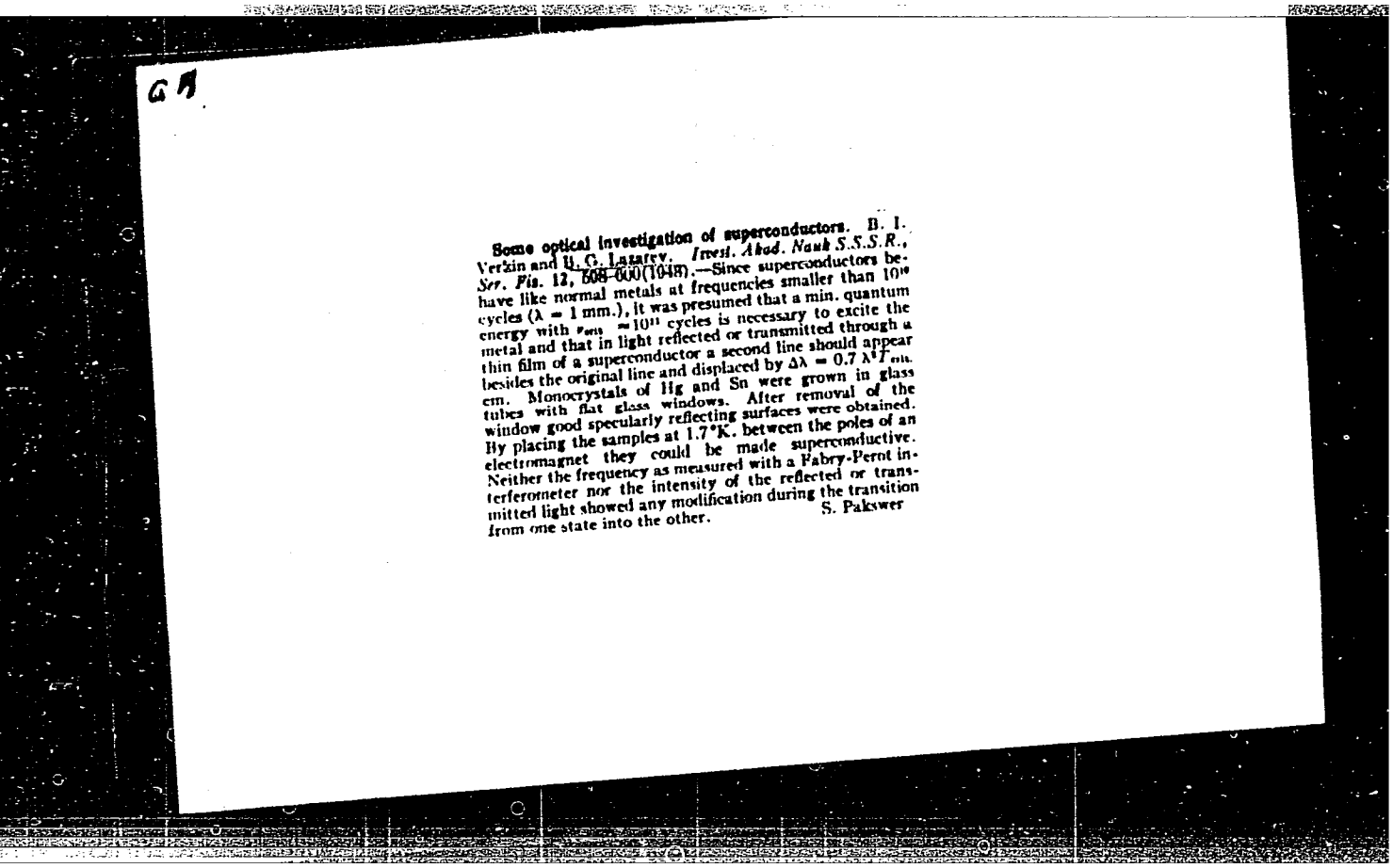

GA

Some optical investigation of superconductors. B. I. Verkin and B. G. Lazarev. *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 12, 508-600(1948).—Since superconductors behave like normal metals at frequencies smaller than 10^{10} cycles (λ = 1 mm.), it was presumed that a min. quantum energy with $\nu_{min} \approx 10^{11}$ cycles is necessary to excite the metal and that in light reflected or transmitted through a thin film of a superconductor a second line should appear besides the original line and displaced by $\Delta\lambda = 0.7\ \lambda^2\nu_{min}$. cm. Monocrystals of Hg and Sn were grown in glass tubes with flat glass windows. After removal of the window good specularly reflecting surfaces were obtained. By placing the samples at 1.7°K. between the poles of an electromagnet they could be made superconductive. Neither the frequency as measured with a Fabry-Perot interferometer nor the intensity of the reflected or transmitted light showed any modification during the transition from one state into the other. S. Paksweer

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LAZAREV, B. G. PA 9/49T48

USSR/Electricity Sep 48
Superconductivity
Tantalum

"Some Particulars of the Superconductivity of Tantalum," B. G. Lazarev, V. I. Khotkevich, Phys-Tech Inst, Acad Sci Ukrainian SSR, 5 pp

"Zhur Eksper i Teoret Fiz" Vol XVIII, No 9

Preliminary research on superconductivity of tantalum demonstrates high superconductivity of this metal under various lattice distortions. Shows anomalous superconducting properties of tantalum as representative of solid superconductors.

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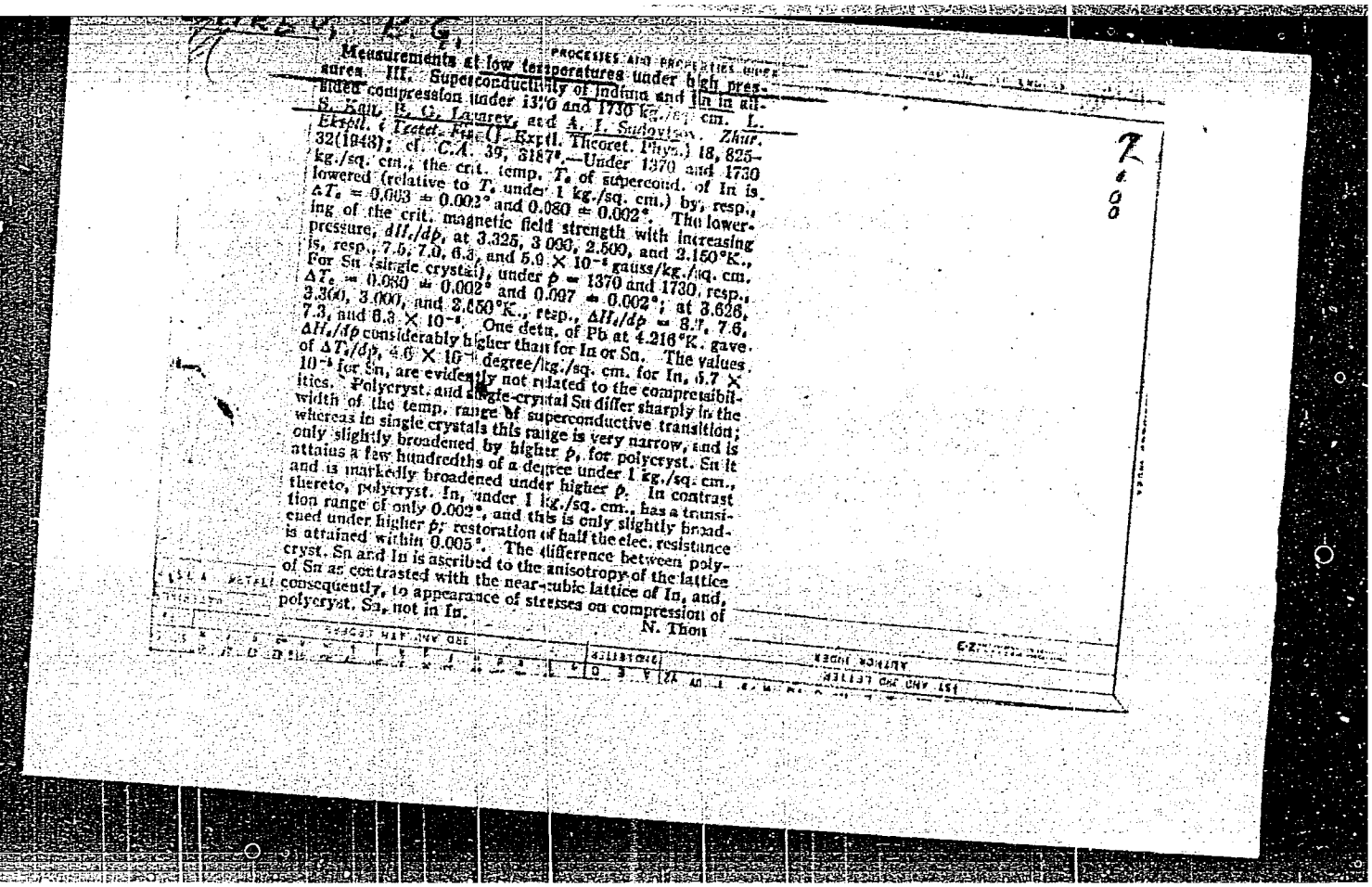

Measurements at low temperatures under high pressures. III. Superconductivity of indium and tin in all-sided compression under 1370 and 1730 kg./sq. cm. L. S. Kan, B. G. Lazarev, and A. I. Sudovtsov. *Zhur. Eksptl. i Teoret. Fiz.* (J. Exptl. Theoret. Phys.) 18, 825–32(1948); cf. *C.A.* 39, 3187*.—Under 1370 and 1730 kg./sq. cm., the crit. temp. T_c of supercond. of In is lowered (relative to T_c under 1 kg./sq. cm.) by, resp., $\Delta T_c = 0.003 \pm 0.002°$ and $0.080 \pm 0.002°$. The lowering of the crit. magnetic field strength with increasing pressure, dH_c/dp, at 3.325, 3.000, 2.500, and 2.150°K., is, resp., 7.5, 7.0, 6.3, and 5.0×10^{-4} gauss/kg./sq. cm. For Sn (single crystal), under p = 1370 and 1730, resp., $\Delta T_c = 0.080 \pm 0.002°$ and $0.097 \pm 0.002°$; at 3.626, 3.360, 3.000, and 2.650°K., resp., $\Delta H_c/dp$ = 8.1, 7.6, 7.3, and 6.3×10^{-4}. One detn. of Pb at 4.216°K. gave $\Delta H_c/dp$ considerably higher than for In or Sn. The values of $\Delta T_c/dp$, 4.6×10^{-4} degree/kg./sq. cm. for In, 5.7×10^{-5} for Sn, are evidently not related to the compressibilities. Polycryst. and single-crystal Sn differ sharply in the width of the temp. range of superconductive transition; whereas in single crystals this range is very narrow, and is only slightly broadened by higher p, for polycryst. Sn it attains a few hundredths of a degree under 1 kg./sq. cm., and is markedly broadened under higher p. In contrast thereto, polycryst. In, under 1 kg./sq. cm., has a transition range of only 0.002°, and this is only slightly broadened under higher p; restoration of half the elec. resistance is attained within 0.005°. The difference between polycryst. Sn and In is ascribed to the anisotropy of the lattice of Sn as contrasted with the near-cubic lattice of In, and, consequently, to appearance of stresses on compression of polycryst. Sn, not in In.

N. Thon

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B. G.

Oscillography of the curve of perturbation of superconductivity by currents of acoustic frequencies. A. A. Galkin and B. G. Lazarev. Zhur. Eksptl. u Teoret. Fiz. (J. Exptl. Theoret. Phys.) 18, 833-6(1948) --An upper limit for the time r required for the transition from the normal to the superconductive state was obtained, for Su, by oscillograms of the voltage V at frequencies up to 20,000 hertzes. At 3.74°K., i.e. somewhat above the transition temp. the oscillogram is very nearly sinusoidal. Below the transition temp., at 8.4°K., the sample is superconducting during the time intervals when the current intensity is below crit., and is normal when the current is above crit. In this case, the oscillograms show horizontal portions corresponding to V = 0. At const current intensity, the width of the horizontal portions increases with decreasing temp. Transition from one state to another is accompanied by a steep jump of V. From its steepness, at 20,000 hertzes, it can be concluded with certainity that r $\leq$ 2 X 10^{-6} sec. Further, the min. velocity of spreading of the boundary between the normal and the superconducting phase can be estd. to 10^{8} cm./sec. N. Thon

Cor Mbr., Ukr. Acad. Sci., 1948 - Stalin 2nd Prize, 1950, publ.

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LAZAREV, B. G.

USSR/Physics
Superconductivity
Frequency, Measurements

Dec 48

"Superconductivity at a Frequency of 1.8. 10^{10} Cycles per Second," A. A. Galkin, B. G. Lazarev, Physicotech Inst, Acad Sci Ukrainian SSR, 1 p

"Zhur Eskper i Teoret Fiz" Vol XVIII, No 12

Discusses reseach on high electromagnetic frequencies which disclosed superconductivity phenomena for various transtitions. Highest frequency achieved was 10^{10} cycles/sec. Submitted 30 Jul 48.

PA 25/49T106

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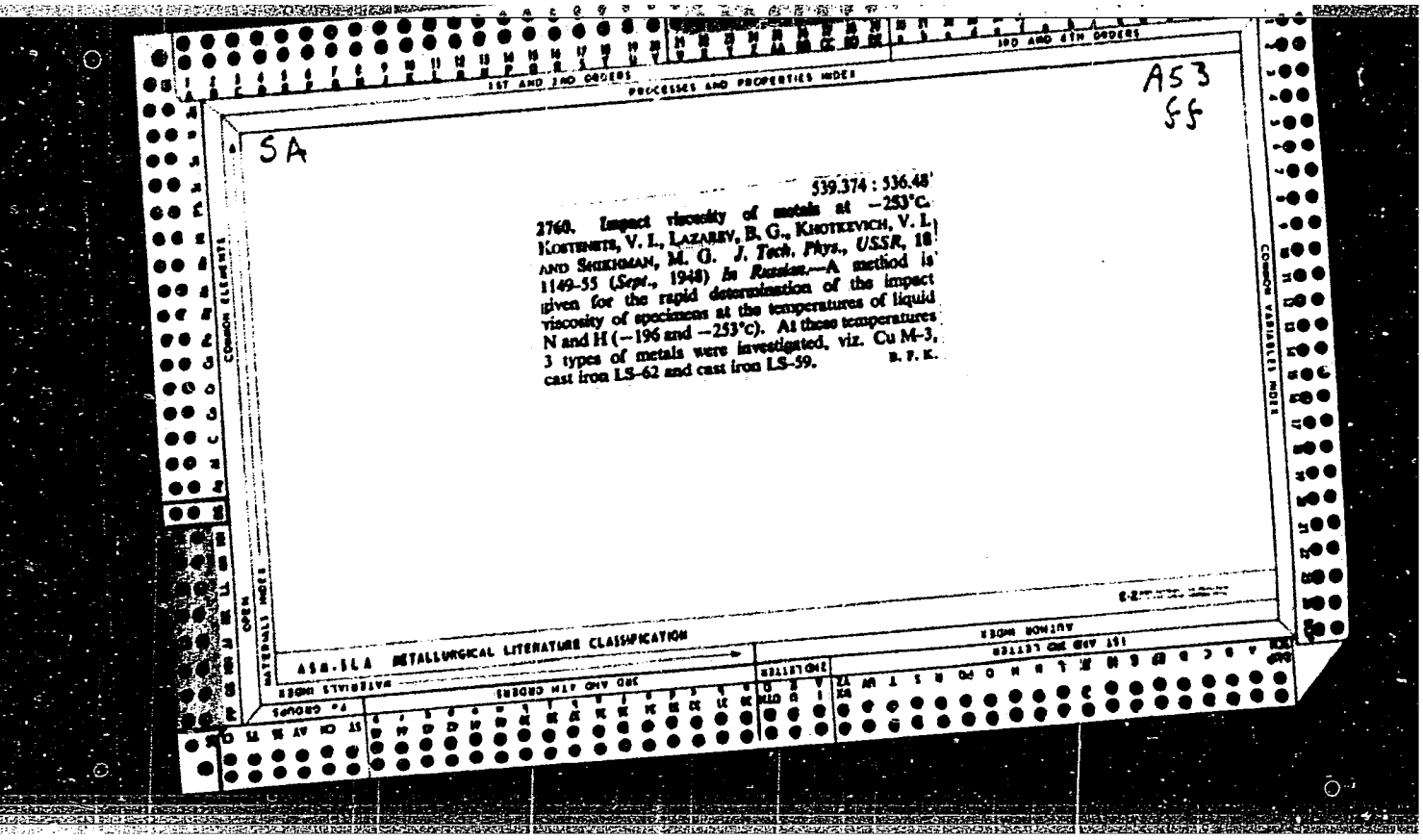

SA

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539.374 : 536.48

2760. *Impact viscosity of metals at −253°C.* KOSTENETS, V. L., LAZAREV, B. G., KHOTKEVICH, V. I., AND SHEKHMAN, M. O. *J. Tech. Phys., USSR*, 18: 1149-55 (*Sept.*, 1948) *In Russian.*—A method is given for the rapid determination of the impact viscosity of specimens at the temperatures of liquid N and H (−196 and −253°C). At these temperatures 3 types of metals were investigated, viz. Cu M-3, cast iron LS-62 and cast iron LS-59. B. F. K.

A53-55A METALLURGICAL LITERATURE CLASSIFICATION

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LAZAREV, B. G.

Detecting properties of superconductors. GALKIN, A. A., AND LAZAREV, B. G. *C.R. Acad. Sci. URSS*, 59 (No. 4) 667-8 (1948) *In Russian*. Experiments by Andrews and collaborators [*Nature*, 61 (1947); 671 (1947); *Phys. Rev.*, 72, 161 (1947)], in which demodulation of a modulated r.f. current is produced by HN-N when it is partly superconducting and partly normal are discussed. This effect is easily explained when a steady biasing current is present by the non-linearity of the voltage/current relation, but occurs even in the absence of biasing current. It is suggested that this is due to an asymmetry caused by "frozen in" fields. New experiment [illegible] demodulation was found in the absence of a [illegible] current, since there was also [illegible] this result is not inconsistent with the suggested [illegible] projection of Andrews' results. D. S.

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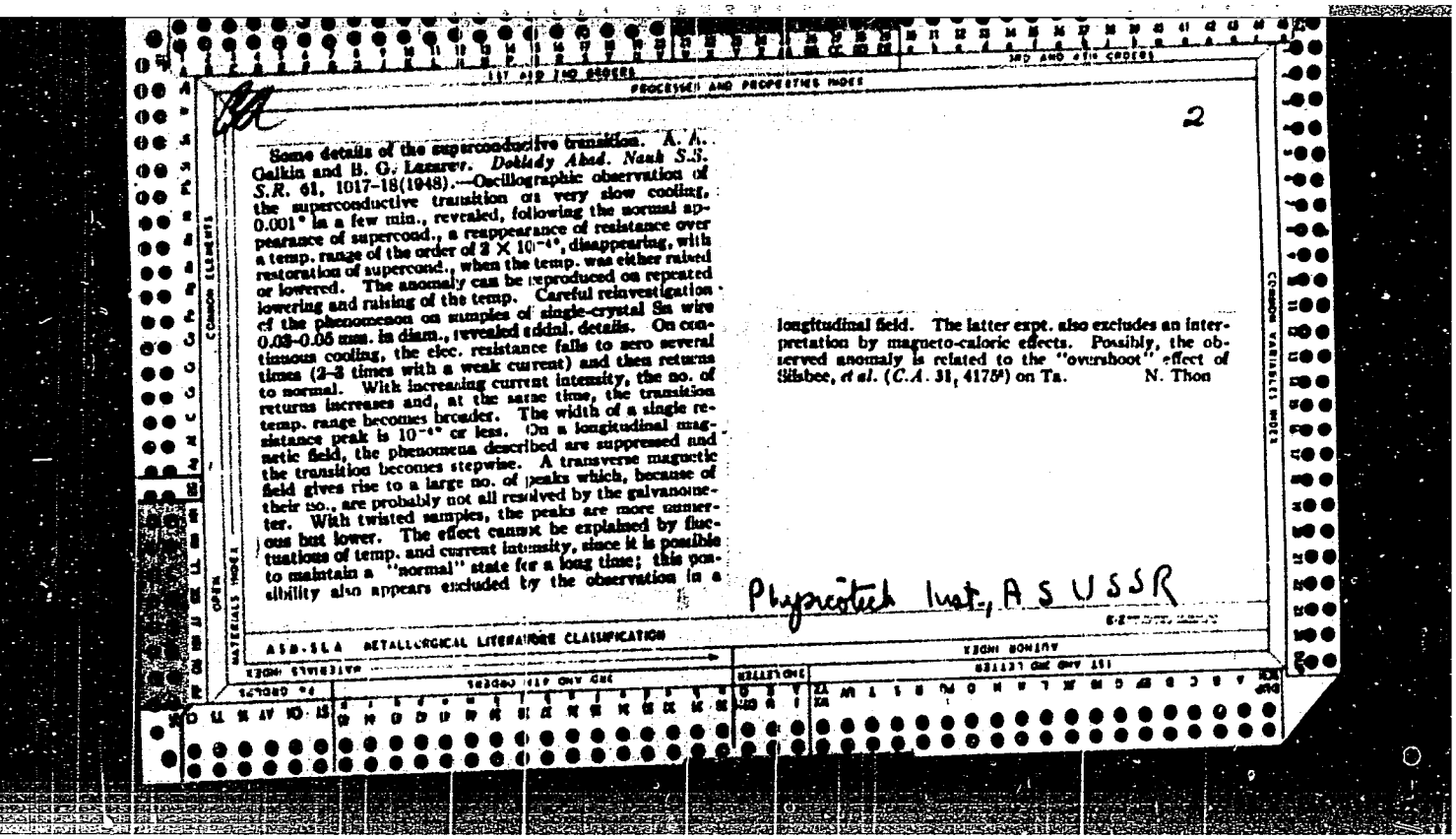

2

Some details of the superconductive transition. A. A. Galkin and B. G. Lazarev. *Doklady Akad. Nauk S.S.S.R.* 61, 1017–18(1948).—Oscillographic observation of the superconductive transition on very slow cooling, 0.001° in a few min., revealed, following the normal appearance of supercond., a reappearance of resistance over a temp. range of the order of 2×10^{-4}°, disappearing, with restoration of supercond., when the temp. was either raised or lowered. The anomaly can be reproduced on repeated lowering and raising of the temp. Careful reinvestigation of the phenomenon on samples of single-crystal Sn wire 0.03–0.05 mm. in diam., revealed addnl. details. On continuous cooling, the elec. resistance falls to zero several times (2–3 times with a weak current) and then returns to normal. With increasing current intensity, the no. of returns increases and, at the same time, the transition temp. range becomes broader. The width of a single resistance peak is 10^{-4}° or less. On a longitudinal magnetic field, the phenomena described are suppressed and the transition becomes stepwise. A transverse magnetic field gives rise to a large no. of peaks which, because of their no., are probably not all resolved by the galvanometer. With twisted samples, the peaks are more numerous but lower. The effect cannot be explained by fluctuations of temp. and current intensity, since it is possible to maintain a "normal" state for a long time; this possibility also appears excluded by the observation in a longitudinal field. The latter expt. also excludes an interpretation by magneto-caloric effects. Possibly, the observed anomaly is related to the "overshoot" effect of Silsbee, *et al.* (*C.A.* 31, 4175⁵) on Ta. N. Thon

Physicotech Inst., A S USSR

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CA.

2.

Effect of shape on the electrical resistance of single crystals of bismuth in a magnetic field. E. S. Borovik and B. G. Lazarev (Acad. Sci. Ukrain. S.S.R., Kharkov). *Doklady Akad. Nauk S.S.S.R.* 62, 611-14(1948).—A new method is given for the expt. detn. of the length of the free path of electrons in Bi by showing the effect of the shape of a sample on the form of the rotation diagram while measuring the resistance in the transverse magnetic field. If the resistance of a sample in the shape of a lamina changes during its rotation about an axis in the direction of the current, the length of the free path of the electrons is equal to its thickness. The effect of the crystallographic anisotropy is excluded by making a monocryst. sample in the shape of a thick rod joined to the lamina. Rotation diagrams for 3 samples differing in orientation and degree of purity show the same effect. As the temp. is lowered, the curves for the rod parts of the samples degenerate to a straight line, owing to the isotropy of the residual resistance. At H temp. there are only traces of crystallographic anisotropy in the curves for the lamina. The min. in the rotation diagram is intensified as the temp. is lowered. The length of the free path is assumed to become equal to the thickness of the lamina at the temp. at which the min. stops changing rapidly. Sample nos., length of free path at the given temps., and length of free path at 0° are: no. 1, 0.1 mm. at 4.2°K., $\sim 10^{-4}$ cm.; no. 2, 0.1 mm. at 20.4°K., $\sim 10^{-3}$ cm; no. 3, 0.5 mm. at ~ 8°K., $\sim 3 \times 10^{-4}$ cm. The value obtained for sample No. 3, which was refined by 5-fold crystn., indicates, possibly, anisotropy of the mean free path in a Bi crystal. The length of the free path could be more precisely detd. by considering the mechanism of the observed effect, but its order of magnitude is correct.

Ellen H. Dunlap

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M

The Change in the Supraconductive Properties of Tantalum on Saturation with Hydrogen. V. R. Golik, B. G. Lazarev, and V. I. Khotkevich (*Zhur. Eksper. i Teoret. Fiziki*, 1949, **19**, (3), 202–206; *C. Abs.*, 1950, **44**, 4742).—[In Russian]. Electrolytic hydrogenation of tantalum wire (0·15 mm. in dia.) in slightly alkaline water results in a broadening of the temp. range of supraconductive transition, increasing with the degree of hydrogenation. At any given temp. between 1·85 and 4·2° K., the electrical resistance ratio $R_T/R_{4\cdot2}$ increased with the amount of occluded hydrogen. At max. saturation with hydrogen, the sample loses supraconductivity altogether, or at least does not become supraconducting down to 1·86° K. The upper limit of the transition range remains unchanged, all samples showing a distinct drop in R at that point. At const. temp. and varying magnetic-field strength, H, hydrogenation again produces increasing broadening of the transition range. This broadening of the transition ranges of T and H makes the determination of the critical values T_c and H_c impossible. The linear plots of H_c against T move to increasingly lower values of T with increasing hydrogen content, with the slope dH_c/dT increasing. The amount of hydrogen occluded varies with the condition of the sample. Thus, if a sample, saturated with hydrogen, is heated 10 hr. at 1700° C. *in vacuo*, its supraconductivity is restored completely. On repeated hydrogenation, supraconductivity is suppressed after occlusion of only $\sim 5 \times 10^{-5}$ mg. of hydrogen, as against 340×10^{-5} mg. which was necessary to suppress supraconductivity originally. In contrast to tantalum, the supraconductivity of niobium is preserved at 4·2° K. after several hours' loading with hydrogen. The effect of hydrogenation on the supraconductivity of tantalum cannot be accounted for by simple expansion of the lattice, but must be due to formation of solid-solution alloys.

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LAZAREV B.G.

4

"On the Volume Change of Tin During the Superconductive Transition in a Magnetic Field. B. G. Lazarev and A. I. Sudovtsov (*Doklady Akad. Nauk* [illegible], 69, (3), 345-347).—[In Russian]. The vol. change of Sn during the transition from the superconducting to the normal state in a magnetic field and its temp.-dependence were studied. The measurements were made using a bimetallic spiral, 4 m. in length, made of Sn and brass welded together with Sn on the outside. The movement of the spiral was transferred to a mirror and read off on a scale. The sensitivity of the apparatus, calculated from the expansion coeff. of Sn and brass and the deflection on the scale/°C., was 3×10^{-4}/division. A possible source of error lies in the thin layer of contaminated Sn at the Sn/brass interface, but this is considered not to be serious. The max. vol. change for Sn calculated from the equation: $\frac{\Delta V}{V} = \frac{H_x}{4\pi}\left(\frac{\partial H_x}{\partial p}\right)_T$, where H_x = critical magnetic field, is $9{\cdot}1 \times 10^{-4}$. The experimental value measured at 1·4° K. was $9{\cdot}06 \times 10^{-4}$. Heisenberg has stated that the main cause of this vol. change is magnetostrictional and describes it as $\frac{H^2}{8\pi}\chi$, where χ is the compressibility const. For Sn at 2° K. $H_x \cong 200$ Oe., $\chi = 1{\cdot}7 \times 10^{-6}$ c.c./kg. Thus, the vol. change $= 2 \times 10^{-6}$, but a figure of this magnitude accounts only for ~2% of the observed effect.—Z. S. B.

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LAZAREV, B. G.

2

Magnetic properties of tin at low temperatures. B. I. Verkin, B. G. Lazarev, and N. S. Rudenko. *Doklady Akad. Nauk S.S.S.R.* 69, 775-6(1949).—Single crystals of Sn at 4.2°K. show very strongly the de Haas-van Alphen effect of periodic variation of the diamagnetic moment
a with the magnetic field, originally established for Bi, but subsequently observed also for Zn (Marcus, *C.A.* 41, 4018c). This behavior of Sn is closely related to the anomalies of the variation of the elec. resistance in a mag-
— netic field (cf. preceding abstr.) and to the Schubnikow-de Haas effect of periodic variation of the elec. resistance in a magnetic field. By measurements of the couple acting on a crystal plate in a homogeneous magnetic field, the
b difference of the magnetic susceptibilities along the main axis and perpendicular thereto, for a crystal with its quaternary axis lying in the plane of the field, decreases by a factor of 3 between 293 and 20°K. A complex periodicity of these susceptibilities appeared at 4.2°. The effect is
— max. when the magnetic vector is close to the quaternary axis. The period and the amplitude of the oscillations increase with H, as for Bi and Zn. In the range of H = 8000-12000, the frequency of the oscillations is much
c greater for Sn than for Bi or Zn. By analysis of the frequencies, the no. of free electrons per atom, responsible for the de Haas-van Alphen effect, is about 400 times greater than in Bi or Zn. For Bi, periodicity of the mag-
— netic susceptibility was observed also in the case of the trigonal axis perpendicular to the magnetic field, contrary to Schoenberg (*C.A.* 33, 8537°). A magnetic periodicity effect was observed also in single crystals of Bi.

1 N. Thon

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LAZAREV, B. G.

538.214

3624. Periodic field-dependence of the magnetic susceptibilities of metals at low temperatures. II. V. VERKIN, B. G. LAZAREV AND N. S. RUDENKO. Letter in *J. Exp. Theor. Phys., USSR*, 20, 93–4 (*Jan.*, 1950) *in Russian*.

[This abstract supplements Abstr. 486 (1951)].

The de Haas-van Alphen effect has been found in Be, Mg, In and Cd. For Be the period of oscillation is 1 000 G at 12 000 G, and the effect is observable at 20°K. For Mg the period is 280 G at 14 000 G and the effect is marked at 4·2 K and below. For In and Cd the periods are only of order 40 G at 14 000 G and the effect becomes marked only below 2°K. [See also Dingle and Shoenberg, Abstr. 1176 (1951)].

D. SHOENBERG

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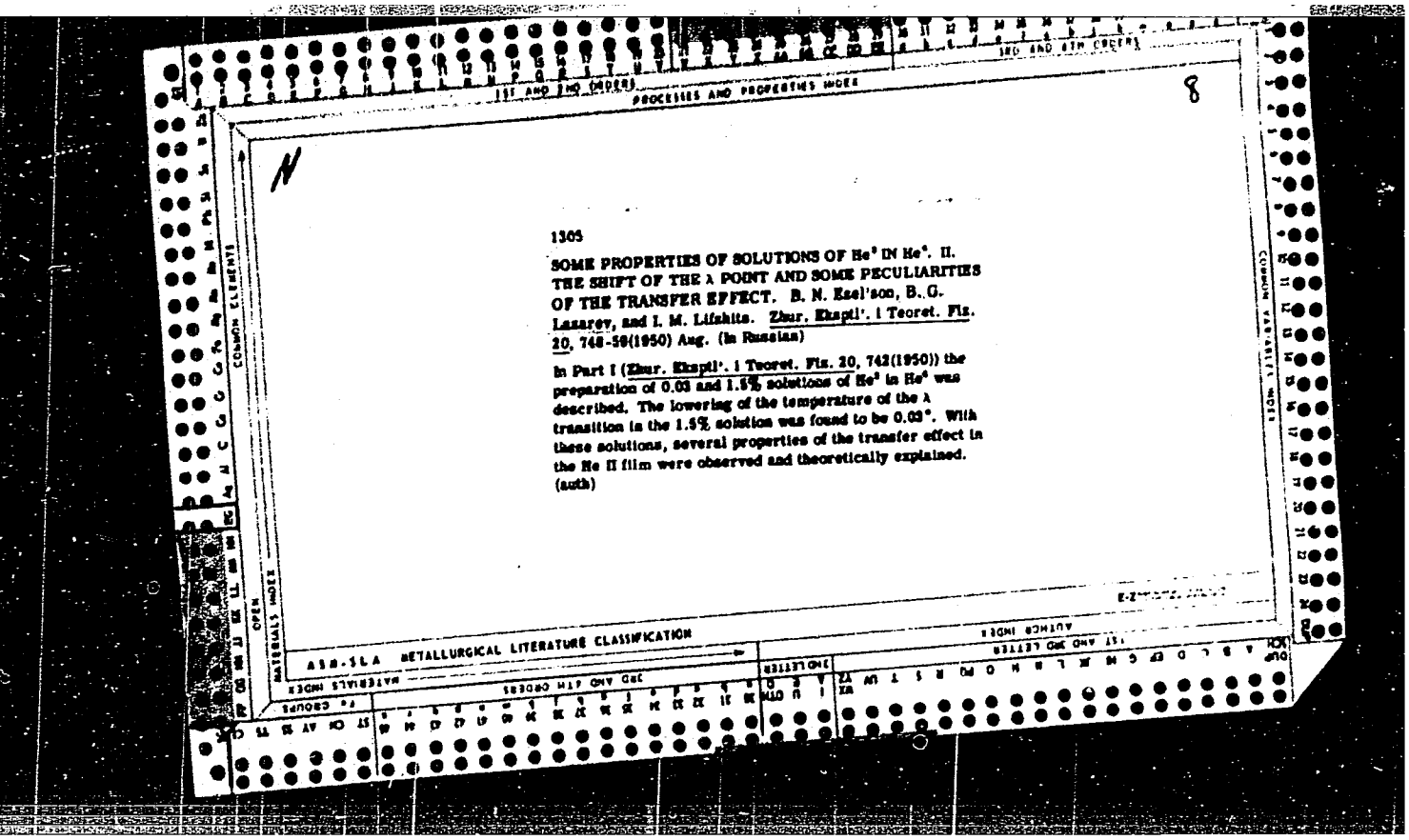

1305

SOME PROPERTIES OF SOLUTIONS OF He^3 IN He^4. II. THE SHIFT OF THE λ POINT AND SOME PECULIARITIES OF THE TRANSFER EFFECT. B. N. Esel'son, B. G. Lazarev, and I. M. Lifshits. Zhur. Eksptl'. i Teoret. Fiz. 20, 748-58(1950) Aug. (In Russian)

In Part I (Zhur. Eksptl'. i Teoret. Fiz. 20, 742(1950)) the preparation of 0.03 and 1.5% solutions of He^3 in He^4 was described. The lowering of the temperature of the λ transition in the 1.5% solution was found to be 0.03°. With these solutions, several properties of the transfer effect in the He II film were observed and theoretically explained. (auth)

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LAZAREV, B. G.

USSR/Physics - Superconductivity Oct 50

"Certain Peculiarities of the Transition to the Superconducting State I,"
A. A. Galkin, Ya. S. Kan and B. G. Lazarev, Physicotech Inst, Acad Sci Ukrainian SSR.

"Zhur Eksper i Teoret Fiz" Vol XX, No 10, pp 865-870.

Shows resistance of metal in region of transition from normal state to superconducting state is not monotonic function of temperature. Investigates influence of magnetic field on nature of this phenomenon. Effect observed is possibly connected with kinetics of transition. Submitted 16 Mar 50.

PA 169T92.

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LAZAREV, B. G.

USSR/Physics - Superconductivity Nov 50

"Certain Peculiarities of the Transition to the Superconducting State, II,"
A. A. Galkin, B. G. Lazarev, P. A. Bezuglyy, Physicotech Inst, Acad Sci Ukrainian SSR

"Zhur Eksper i Teoret Fiz" Vol XX, No 11, pp 987-994

Uses independent methods to determine velocity of displacement of boundary between normal and superconducting states (v is about 1,000 cm/sec). Shows this velocity differs when superconductivity is disrupted by constant and variable magnetic fields. Submitted 30 Mar 50.

PA 169T101

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M.A.

Preparation of Metals

Magnetic Properties of Metals at Low Temperatures. I.—The Periodic Change in the Magnetic Susceptibility of Single Crystals of Cadmium, Beryllium, Magnesium, Tin, [Zinc, Bismuth], and Indium with the Strength of the Magnetic Field. B. I. Verkin, B. G. Lazarev, and N. S. Rudenko (*Zhur. Eksper. Teoret. Fiziki*, 1950, **20**, (11), 995–1010).—[In Russian]. The difference between the principal magnetic susceptibilities of Zn, Sn, Cd, Be, Mg, In, and Bi single crystals was measured in magnetic fields up to 14,000 Oe. at temp. between room temp. and 1·84° K. The Mg and Be specimens were produced as single crystals of commercial purity, the Zn, Cd, and Bi being obtained from Hilger and the In from the firm Sachtleben. Single crystals of all the metals except Be and Mg were grown by the Obreimov-Shubnikov method (*Z. Physik*, 1924, **25**, 31; *J. Inst. Metals* (Abstracts), 1925, **34**, 384) after melting in vacuo, or by a special method of slowly cooling small spherical drops of molten metal. The residual resistivities of all the metals were measured at 4·2° K. and found to be satisfactorily low. The susceptibility measurements were made as described by V., L., and R. (*Zhur. Eksper. Teoret. Fiziki*, 1950, **20**, (1), 93). The values obtained for the difference between the principal susceptibilities were as follows: for Bi, $0{\cdot}420 \times 10^{-6}$ at 293° K.; for Zn, $-0{\cdot}050 \times 10^{-6}$ at 293° K.; for Cd, $-0{\cdot}158 \times 10^{-6}$ at 293° K.; for white Sn, $-0{\cdot}006 \times 10^{-6}$ at 293° K.; for In, $0{\cdot}107 \times 10^{-6}$ at 293° K., $0{\cdot}345 \times 10^{-6}$ at 78° K., $0{\cdot}425 \times 10^{-6}$ at 20·4° K., and $0{\cdot}445 \times 10^{-6}$ at 2° K.; for Be, $2{\cdot}48 \times 10^{-6}$ at 293° K. and $3{\cdot}25 \times 10^{-6}$ at 20·4° K.; for Mg, $0{\cdot}075 \times 10^{-6}$ at 293° K., $0{\cdot}068 \times 10^{-6}$ at 78° K., and $0{\cdot}054 \times 10^{-6}$ at 14° K. The periodic variation of magnetic susceptibility with field strength was observed as follows: in Zn at 20·4° K. in agreement with Sydoriak and Robinson (*Phys. Rev.*, 1949, [ii], **75**, 118; *M.A.*, **18**, 469); in Cd at 1·84° K., in Be at 14°, 4·2°, and 1·98° K., in Mg at 4·2° K., and in In at 1·84° K. as described previously by V., L., and R. (*loc. cit.*); in Sn at 4·2° K., with an oscillation period from 70 Oe. at 10,000 Oe. to 125 Oe. at 14,000 Oe. The behaviour of Bi, Zn, and Be, when the magnetic field was rotated about a vertical axis, indicates anisotropy in the basal planes of the crystals at low temp. V., L., and R. explain some previous negative results with the metals enumerated above by the insufficiently uniform or insufficiently strong fields used. Comparison of known metals showing the de Haas-van Alphen effect indicates that, in metals with the same crystal structure, the lower Debye temp. is associated with the lower temp. for the appearance of the effect.—G. B. H.

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Chem Abstracts

General and Physical Chemistry

Measurement of the vapor pressure over solutions of He^4 in He^3. B. N. Esel'son, B. G. Lazarev, and N. E. Alekseevskii (Phys.-Tech. Inst., Acad. Sci. Ukr. S.S.R., Kiev). *Zhur. Eksptl. Teoret. Fiz.* 20, 1055-6(1950).—The validity of Raoult's law was confirmed by the agreement of the concns. calcd. from the vapor pressure at 1.4°K. with the known concns. of He^3, 0.15, 0.38, 0.98, and 1.80%. The agreement is satisfactory only with a sufficient amt. of liquid; too-small amts. give too-low figures for the concn.
N. Thon

1951

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CA

Some properties of solutions of helium³ in helium⁴. B. N. Esel'son and B. G. Lazarev. *Doklady Akad. Nauk S.S.S.R.* 72, 265–7(1950).—Natural He was enriched in He^3 by a factor of about 10^3 by the use of the thermomech. effect, then further by a factor of about 200 by distn.; the highest concn. of He^3 in He^4 was 1.5%, as detd. by the vapor pressure. From detns. of the rate of overflow between 2 capillary branches, the λ point of transition from He I to He II is shifted, in a 1.5% soln. of He^3 in He^4, by 0.02°, as compared with an exptl. error of 0.005°. The sign of the displacement is the contrary of the sign predicted by Stout (*C.A.* **43**, 22*h*); the magnitude of the displacement of the temp. θ as a function of the concn. c of He^3, $\partial\theta/\partial c = 1.3$, is at variance with the value (5) of Abraham, *et al.* (*C.A.* **44**, 394*a*). Whereas in He^4 the rate of flow is independent of the difference of levels Δh, in He enriched with He^3 that rate, v, decreases with the progress of leveling; when Δh becomes small, v is very nearly a linear function of Δh. At a sufficiently low temp., the portion along which v is const. disappears altogether. This effect is due to an enrichment of the nonoverflowing liquid in He^3, partly compensated by an equalization of the concns. through the gas phase, with the latter process becoming rate-detg. HeII exists at 1.4°K. in the presence of at least up to 30% He^3.

N. Thon

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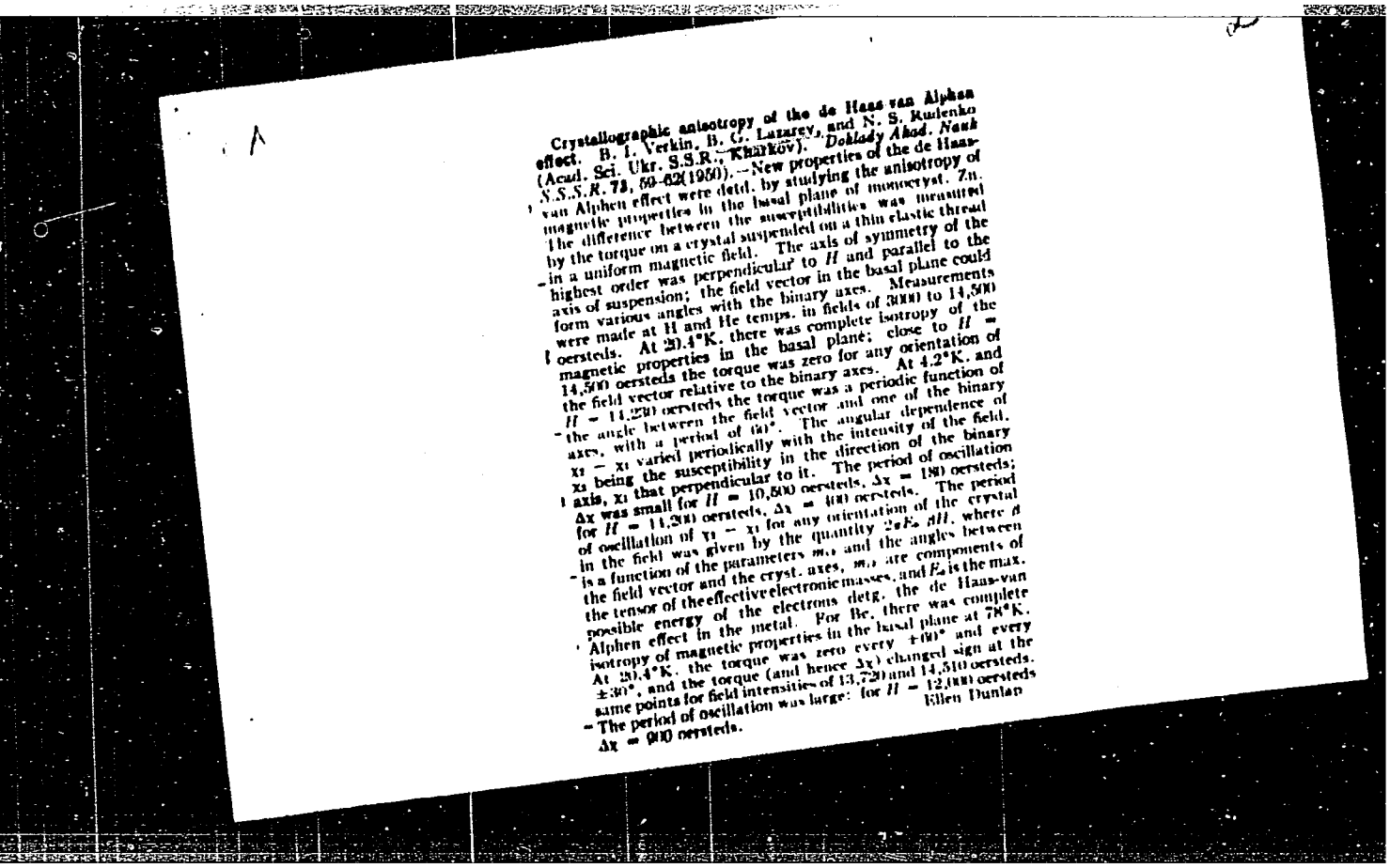

Crystallographic anisotropy of the de Haas van Alphen effect. B. I. Verkin, B. G. Lazarev, and N. S. Rudenko (Acad. Sci. Ukr. S.S.R., Kharkov). *Doklady Akad. Nauk S.S.S.R.* **73**, 69–62(1950).—New properties of the de Haas-van Alphen effect were detd. by studying the anisotropy of magnetic properties in the basal plane of monocryst. Zn. The difference between the susceptibilities was measured by the torque on a crystal suspended on a thin elastic thread in a uniform magnetic field. The axis of symmetry of the highest order was perpendicular to H and parallel to the axis of suspension; the field vector in the basal plane could form various angles with the binary axes. Measurements were made at H and He temps. in fields of 3000 to 14,500 oersteds. At 20.4°K. there was complete isotropy of the magnetic properties in the basal plane; close to H = 14,500 oersteds the torque was zero for any orientation of the field vector relative to the binary axes. At 4.2°K. and H = 14,250 oersteds the torque was a periodic function of the angle between the field vector and one of the binary axes, with a period of 60°. The angular dependence of $x_2 - x_1$ varied periodically with the intensity of the field, x_2 being the susceptibility in the direction of the binary axis, x_1 that perpendicular to it. The period of oscillation Δx was small for H = 10,500 oersteds, Δx = 100 oersteds; for H = 14,200 oersteds, Δx = 100 oersteds. The period of oscillation of $x_2 - x_1$ for any orientation of the crystal in the field was given by the quantity $2\pi K_0 H$, where δ is a function of the parameters m_0 and the angles between the field vector and the cryst. axes, m_0 are components of the tensor of the effective electronic masses, and K_0 is the max. possible energy of the electrons detg. the de Haas-van Alphen effect in the metal. For Be, there was complete isotropy of magnetic properties in the basal plane at 78°K. At 20.4°K. the torque was zero every +60° and every ±30°, and the torque (and hence Δx) changed sign at the same points for field intensities of 13,720 and 14,510 oersteds. The period of oscillation was large: for H = 12,000 oersteds Δx = 900 oersteds.

Ellen Dunlap

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LAZAREV, B. G.

Magnetic properties of antimony at low temperatures. B. I. Verkin, B. G. Lazarev, and N. S. Rudenko (Phys. Tech. Inst. Acad. Sci. Ukr. S.S.R., Kharkov). Zhur. Eksptl. Teoret. Fiz. 21, 658-9(1951); cf. C.A. 45, 9318i.— In single crystals of Sb, suspended with the 3rd-order symmetry axis perpendicular to the suspension axis, and one of the binary axes along the suspension, periodic variation of $\Delta\chi = \chi_{\parallel} - \chi_{\perp}$ (difference of magnetic susceptibilities parallel and perpendicular to the trigonal axis) with the magnetic field H (measured by the couple acting on the suspended crystal in a homogeneous magnetic field, forming an angle φ with the 3rd-order symmetry axis in the horizontal plane) manifests itself only weakly at 4.2°K., but is distinct at 2.04°K.; at $\varphi = 53°$, the effect begins to appear at H ~ 9500 oersteds, and the amplitude of the oscillations increases with H, becoming 150 oersteds at H = 11,000, and 250 oersteds at H = 14,000. At const. H = 13,400 the oscillations of the couple are large around $\varphi = 45°$, and diminish towards $\varphi = 0°$ and 90°. Shoenberg's (C.A. 44, 5165g) repeated failure to detect the effect in Sb at 1.4°K, could be due either to insufficient H or to too large intervals.

N. Thon

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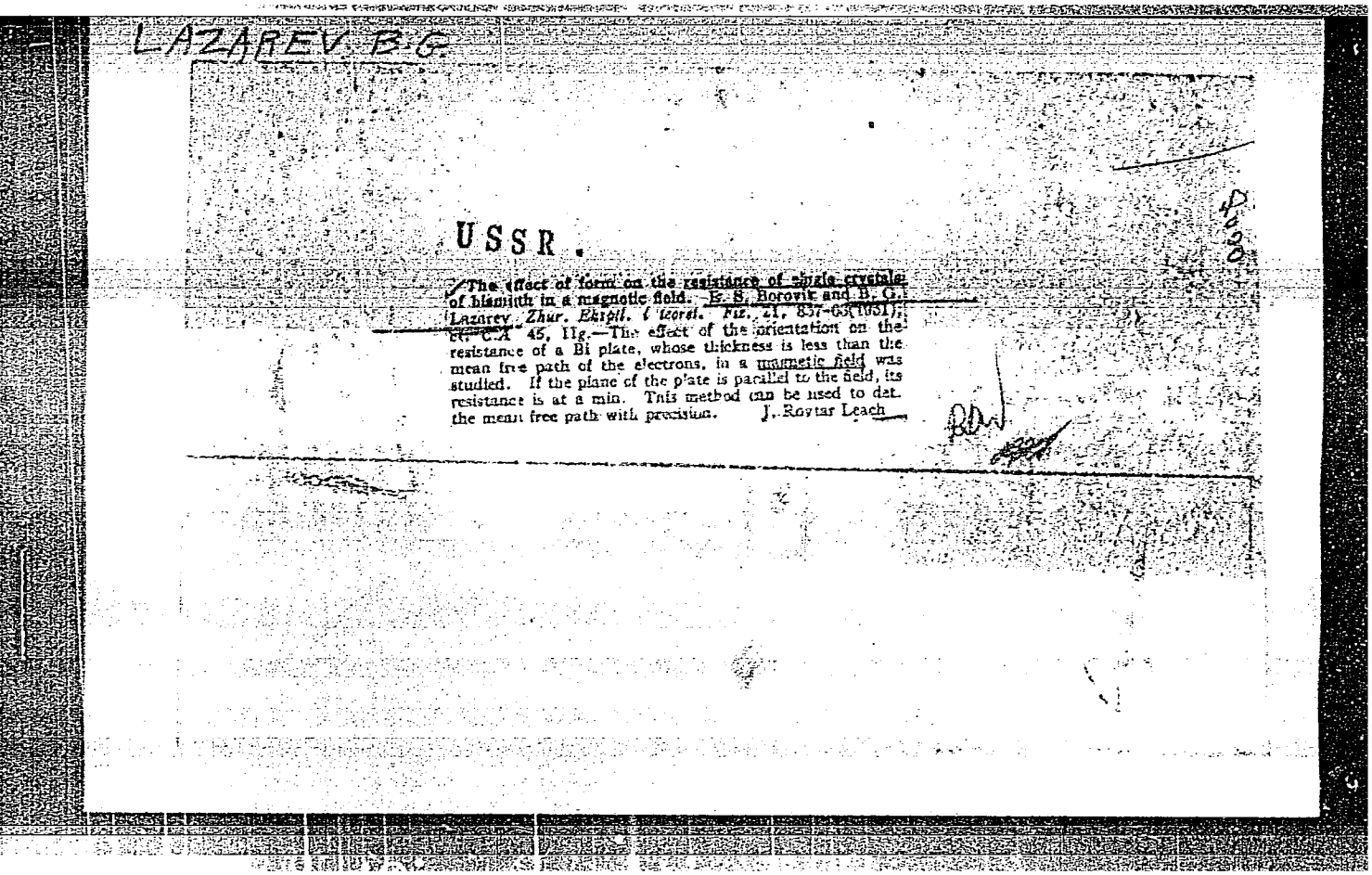

LAZAREV, B.G.

USSR.

The effect of form on the resistance of single crystals of bismuth in a magnetic field. K. S. Borovik and B. G. Lazarev. *Zhur. Eksptl. i Teoret. Fiz.*, 21, 857-65(1951); cf. C.A. 45, 11g.—The effect of the orientation on the resistance of a Bi plate, whose thickness is less than the mean free path of the electrons, in a magnetic field was studied. If the plane of the plate is parallel to the field, its resistance is at a min. This method can be used to det. the mean free path with precision. J. Roytar Leach

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Sect. A

Crystallography

548.733

6175. A low-temperature X-ray camera. L. S. KAN AND B. G. LAZAREV. *Zh. Tekh. Fiz.*, 21, 1542–3 (*No.* 12, 1951) *In Russian.*

A small powder camera was constructed for use at the temperature of liquid N or H. The metal camera complete with slits and with the film held to the outside cylindrical surface by a metal band was suspended inside a metal Dewar flask and was maintained at the temperature of the liquid by conduction through a Cu rod. Four Be windows permitted the X-ray beam to pass through the apparatus. No provision was made for rotating the specimen. A. L. MACKAY

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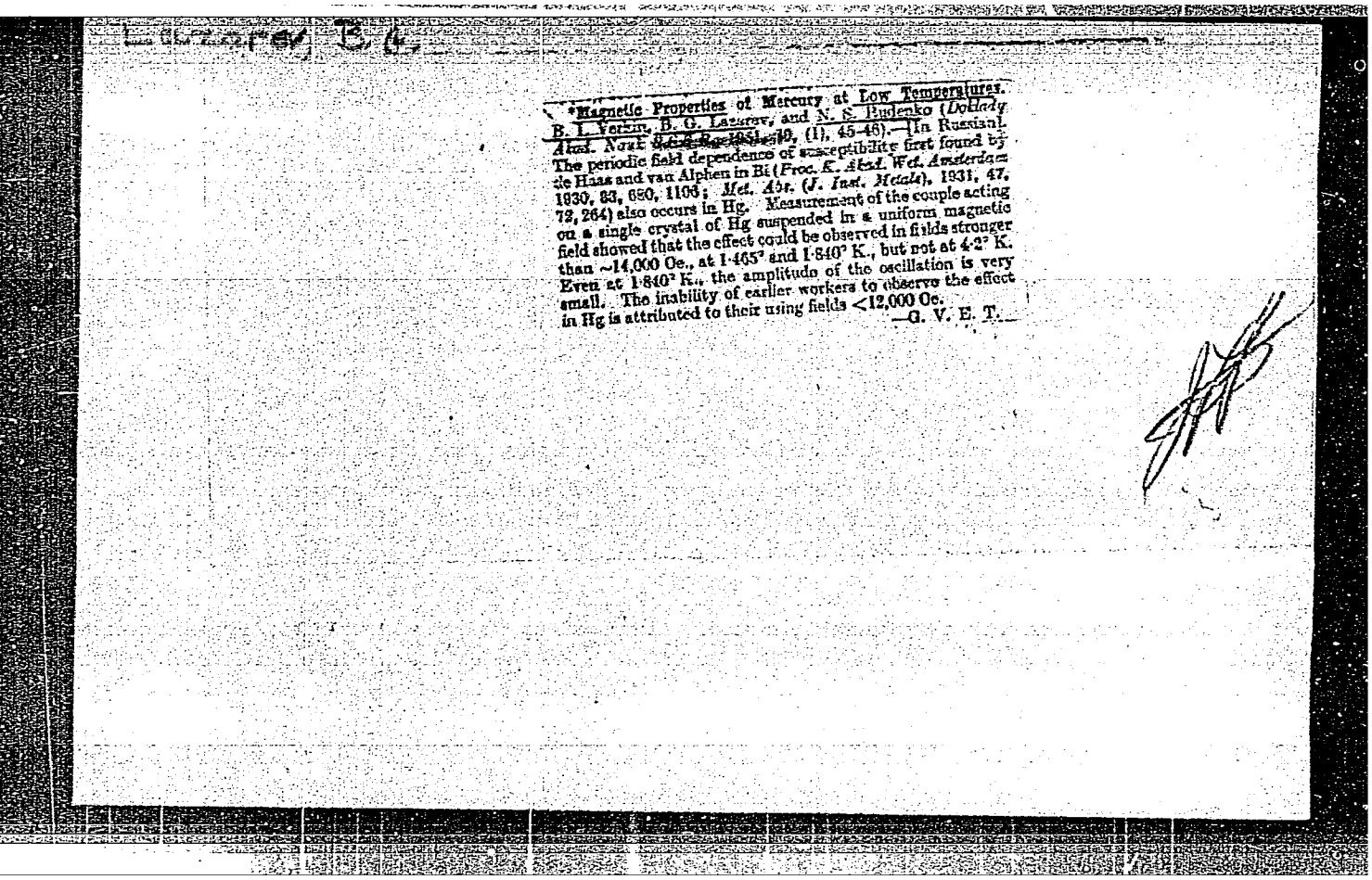

*Magnetic Properties of Mercury at Low Temperatures. B. I. Verkin, B. G. Lazarev, and N. S. Buslenko (*Doklady Akad. Nauk S.S.S.R.*, 1951, **79**, (1), 45-48).—In Russian. The periodic field dependence of susceptibility first found by de Haas and van Alphen in Bi (*Proc. K. Akad. Wet. Amsterdam*, 1930, **33**, 650, 1106; *Met. Abs. (J. Inst. Metals)*, 1931, **47**, 72, 264) also occurs in Hg. Measurement of the couple acting on a single crystal of Hg suspended in a uniform magnetic field showed that the effect could be observed in fields stronger than ~14,000 Oe., at 1·465° and 1·840° K., but not at 4·2° K. Even at 1·840° K., the amplitude of the oscillation is very small. The inability of earlier workers to observe the effect in Hg is attributed to their using fields <12,000 Oe.
—G. V. E. T.

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USSR/Physics - Helium II, Transfer 1 Dec 51
Speed of

"The Speed of Transfer in a Film of Helium II," B. N. Yesel'son, B. G. Lazarev, Phys-Tech Inst, Acad Sci Ukrainian SSR

"Dok Ak Nauk SSSR" Vol LXXXI, No 4, pp 537-539

Important in the theory of He II is the problem concerning the existence of the crit velocity. It is desirable to set up new expts under conditions which exclude all possible distorting circumstances. Authors report certain results of expts set up under such conditions. They obtain the dependence of the height of

202T89

USSR/Physics - Helium II, Transfer 1 Dec 51
Speed of (Contd)

helium's level upon time at T=1.52°K. Submitted by Acad L. D. Landau 3 Oct 51.

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LAZAREV, B. G.

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LAZAREV, B.G.

USSR/Physics - Resistance at Low Tempera- 21 Dec 51
tures

"Problem Concerning the Minimum Resistance of Magnesium at Low Temperatures," L. S. Kan, B. G. Lazarev, Phys-Tech Inst, Acad Sci Ukrainian SSR

"Dok Ak Nauk SSSR" Vol LXXXI, No 6, pp 1027-1029

The results of expts by the authors on magnesium and gold indicate the absence of subject min in the temp behavior of resistance at low temps in the case of pure metals. The phenomenon of such a min remains incomprehensible in the case where there are very insignificant amts of admixts in the metal. Submitted by Acad M. A. Leontovich 3 Oct 51.

215T68

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

USSR/Physics - Helium II Nov 52

"New Peculiarities of Transfer Effect of He II Film," B. N. Yeselson and B. G. Lashkarev, Phys Tech Inst, Acad Sci Ukrainian SSR

"Zhur Eksper i Teoret Fiz" Vol 23, No 5, pp 552-563

Subject effect is studied under best obtainable conditions. Dependence of transfer velocity on height of film and on procedure of filling of flask with He was established. It was shown that velocities of inflow and outflow are different. Further expts are under way. Indebted to M. I. Kaganov and S. A. Shigimago. Received 16 Feb 52.

236T82

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

USSR/ Physics Isotopes

Card : 1/1

Authors : Esel'son B. N. and Lazarev, B. G., Act. Memb. of Acad. of Sc. Ukr-SSR

Title : Solidification of helium isotope mixtures

Periodical : Dokl. AN SSSR, 97, Ed. 1, 61 - 64, July 1954

Abstract : Data are presented on the solidification point of pure He^4 as well as helium isotope mixtures obtained by a previously described method. The experimental installation and the investigation procedure are described. The data obtained (shown in graph) make it possible to evaluate the nature of the structural diagram for liquid and solid phases of the He^3 - He^4 system. The pressure at which helium solidifies was recorded with greater accuracy by means of two manometers the indications of which coincided with each other only as long as the helium remained in liquid state. Nine references: 3 USSR, 4 USA, 2 German. Graphs, drawing.

Institution : Acad. of Sc. Ukr-SSR, Physico-Technical Institute

Submitted : March 25, 1954

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B. G.

USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds, E-9

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34862

Author: Garber, R. I., Gindin, I. A., Kogan, V. S., Lazarev, B. G.

Institution: None

Title: Investigation of Plastic Properties of Beryllium Monocrystals

Original Periodical: Fiz. metallov i metallovedeniye, 1955, 1, No 3, 529-537

Abstract: Specimens made of Be (99.7%) were subjected to single-axis compression at temperatures from -253 to 800°. The speed of deformation was constant (0.03 mm/sec). At higher temperatures, the tests were performed in vacuum. The specimens were shaped as rectangular parallelopipeds. The axis of the compressing forces was in the plane of the base (001). Over the entire temperature range, the deformation of Be was accompanied by the appearance of twin streaks. The twins occurring at -253 and 196°, were characterized by small thickness (2-4 mu) owing to the considerable reinforcement on their boundaries with the mother crystal. At higher temperatures, thicker streaks are formed. When the individual streaks merge with each other, the entire volume of the crystal is transformed into the twin state without damage to its solidity. The

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USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds, E-9

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34862

Author: Garber, R. I., Gindin, I. A., Kogan, V. S., Lazarev, B. G.

Institution: None

Title: Investigation of Plastic Properties of Beryllium Monocrystals

Original Periodical: Fiz. metallov i metallovedeniye, 1955, 1, No 3, 529-537

Abstract: transition of the Be monocrystal into a fully-twinned state is related to the process of mechanical twinning in the (102) plane, and is particularly easy to effect at 400° and above. In addition to the principal system of twins along (102), one observes also twins in the (101) and (103) planes. The mechanism of slipping of Be depends substantially on the temperature and orientation of the specimen. In some specimens, base slipping is observed even at -196°. The plasticity of Be, which increases monotonically with temperature, reaches a maximum at 400° (δ = 26%) and diminishes somewhat at 600°, and increases again at 800°. The mechanical characteristics of the plasticity of monocrystals of beryllium are determined, and their dependence on temperature. The yield point when slipping along the (100) and (101) planes diminishes by approximately 4 times when heated from 200 to 800°.

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LAZAREV, B.G.

537.311.31 : 548.7

8743. The effect of holes in a crystal lattice on the electric resistance of a metal. B. G. LAZAREV AND O. N. OVCHARENKO. *Dokl. Akad. Nauk SSSR*, 100, *No.* 5, 875–8 (1955) In Russian.

It is pointed out that holes may be formed in a metal lattice by heating it to a fairly high temperature, and then "frozen" in the lattice by rapid cooling to a temperature at which the hole diffusion coefficient is small. The holes will then cause an additional electric resistance. Measurements were made on gold and platinum wire heated electrically to various temperatures. The relations obtained are in agreement with the theoretical formulae, thus favouring the hypothesis that holes actually exist, and that the extra resistance is not due to deformations arising on cooling, which would give a different relation. The disappearance of holes from the metal on annealing at various temperatures is in accordance with a diffusion mechanism. The heats of formation of holes, their concentration, and their diffusion coefficient are calculated for gold and platinum.

J. B. SYKES

(1)

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B. G., VERKIN, B. I., DMITRENKO, I. M., MIKHAYLOV, I. F., (Kharkov)

"Magnetic Properties of Non-Ferromagnetic Metals at Low Temperatures," a paper submitted at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, 23-31 May 56.

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

Category : USSR/Solid State Physics - Morphology of Crystals. Crystallization E-7

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3932

Author : Aleksandrov, B.N., Verkin, B.I., Lazarev, B.G.
Inst : Physicotechnical Institute, Academy of Sciences Ukrainian SSR
Title : Obtaining Pure Metals by the Zone Crystallization Method. I. Obtaining Pure Tin.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 2, No 1, 93-99

Abstract : The purity of the initial and recrystallized tin is characterized by the relative value of the residual electric resistivity $\delta = R_{4.2}/R_r$, where $R_{4.2}$ is the resistance of the investigated specimens of tin at the boiling point of liquid helium under normal pressure conditions, and R_r is the resistance of the same specimen at room temperature. When measuring the residual resistance of individual "samples", the specimens were prepared in the form of thin wires (0.1 mm in diameter) obtained by melting a piece of metal in a glass capillary tube and stretching it into a thread. The wires were annealed at 120 -- 140° for one hour. Curves are given for the dependence of the residual resistance of tin in the initial and final

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

Category : USSR/Solid State Physics - Morphology of Crystals. Crystallization E-7

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3932

portion of the ingot on the number of the recrystallizations. Eight to ten recrystallizations are enough to complete the tin-purification process. It can be seen from a graph showing the distribution of the impurities along the ingot after tin recrystallization, that in half the length of the ingot the impurity concentration is at a minimum and is constant. The impurities are concentrated at the end of the specimen (approximately 0.25 of the length of the ingot). From the scheme of the fractional multiple zone crystallization it can be seen that commercial tin contains impurities with $K \ll 1$ and $K > 1$ (K is the coefficient of impurity destribution, $K = C_{\text{solid}}^{\text{imp.}} / C_{\text{lig}}^{\text{imp.}}$; C is the concentration).

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

Category : USSR/Solid State Physics - Morphology of Crystals. Crystallization E-7

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3933

Author : Aleksandrov, B.N., Verkin, B.I., Lazarev, B.G.
Title : Obtaining Pure Metals by the Zone Crystallization Method.II. Obtaining Pure Tin by a Combination of the Zone Crystallization Method with Purification of Metal from Volatile Impurities by Prolonged Heating in High Vacuum.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 2, No 1, 100-104

Abstract : High temperature heating of tin in vacuum reduces noticeably the contents of impurities with $K > 1$, and further multiple zone crystallization guarantees a more effective removal of the impurities of this kind remaining in the ingot. The use of fractionized multiple zone crystallization for the purification of chemically pure tin with initial value of $\delta = (1.4 -- 1.6) \times 10^{-3}$ has made it possible to obtain a metal with $\delta = 2.7 \times 10^{-4}$. A subsequent 10-hour heating of this metal at 1000° and a pressure of 10^{-6} mm mercury reduced the residual resistance to $(2.0 -- 2.1) \times 10^{-4}$.

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Crystalline Compounds E-9

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6787

Author : Garber, R.I., Gindin, I.A., Kogan, V.S., Lazarev, B.G.
Inst : Physico-Technical Institute, Academy of Sciences, Ukraine SSR
Title : X-ray Investigation of the Plasticity of Single Crystals of Beryllium

Orig Pub : Izv. AN SSR, ser. Fiz., 1956, 20, No 6, 639-640

Abstract : X-ray diffraction, metallography and micro-interferometry have been used to investigate single crystals of beryllium, cut in the form of ractangular perallelopipeds, with one of the faces aligned with the plane of the base. The specimens were deformed by unilateral compression at temperatures from -253 to 800°. The results of the investigations are summarized in a table.

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Crystalline Compounds

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6737

Abstract :

Orientation of Single Crystal	Character of Plasticity of Its Elements: Mechanical Twining		Total Reori-on-tation; symmo-try place (102)		Slippago	
Binary Axis [100] perpendicular to compression axis			400° plus		400/800° in twin region.	200/800° in e-rig. ro- sin-gion. glo crys-tal
Binary Axis [100] PARallel to compression axis	400° Plus	400° plus	Room Temp-& above	196/800° in twin region		

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

21 538.22

21 21 2412. EFFECT OF HYDROSTATIC PRESSURE ON MAGNETIC PROPERTIES OF MONOCRYSTALLINE [illegible] AT LOW TEMPERATURES. [illegible]

[illegible]

pressure [illegible]
altered the [illegible]
nearly parallel to [illegible] and decrease for field nearly perpendicular [illegible]
trigonal axis [illegible] caused an appreciable increase in
the anisotropy of the steady susceptibility [illegible]

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

CARD 1 / 2 PA - 1613

SUBJECT USSR / PHYSICS
AUTHOR KOGAN, V.S., LAZAREV, B.G., BULATOVA, R.F.
TITLE The Crystal Structure of Hydrogen and Deuterium.
PERIODICAL Zurn.eksp.i teor.fis, 31, fasc.3, 541 - 541 (1956)
Issued: 12 / 1956

The present work investigates the structure of solid deuterium. The samples of liquid D were produced by condensation on a copper capillary filled with liquid helium. By the method of sharp focussing roentgenographs with distinct lines were obtained after exposure of from 1 to 2 hours. Unfortunately, the lines of D are visible only under small angles, which renders a reliable interpretation of the X-ray pictures and an exact determination of lattice parameters difficult. With the highest degree of reliability attainable in this case, the structure of D was determined as tetragonal with the axial ratio c/a = 0,94 and with the parameter a = 5,4 Å . The density D in this case amounted to 0,18 g/cm^3. This result made it necessary tocheck the data concerning the structure of hydrogen, because the difference in the structure of the lattices of H and D appeared strange. Such a difference could occur particularly in the case of the existence of a polymorphism with a transformation temperature of ~4,2° K in both isotopes. However, neither H nor D change their structure at from 1,5 to 4,1° K. In the work by W.H.KEESOM et al.Comm.Phys.Univ.Leiden, 209 d,(1930) on the structure of solid H no roentgenographs are mentioned, but they apparently consist of individual reflexes through which DEBYE's arcs were plotted. A simple utilization of such a roentgenograph taken in accordance with the conditions

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LAZAREV, B.G.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1779
AUTHOR ESEL'SON,V.N., LAZAREV,B.G., SINEL'NIKOV,K.D., ŠVEC,A.B.
TITLE On Some Peculiarities of Rotating He II.
PERIODICAL Žurn.eksp.i teor.fis,31,fasc.5,912-912 (1956)
Issued: 1 / 1957

At first several previous works dealing with this topic are cited. An experimental confirmation of the dependence of the inertia moment of rotating He II on velocity and an estimation of relaxation time would be most desirable. This problem could be solved by studying the damping of the rotation of a glass with He II which is the nearest approach to the continuous equilibrium between the normal and the supraconductive component. As relaxation time was not known, the rotating system had to have a sufficiently low damping. For this purpose a plexiglass vessel was suspended in a magnetic field which warranted rotation of the vessel for several hours after an initial velocity of several revolutions per second had been imparted to it. The vessel (R = 1,5 cm) contained about 300 light aluminium disks which were arranged at a shorter distance than the depth of penetration of the viscous wave. With the help of a rotating magnetic field the rotation velocity of the vessel containing the He II was brought up to the assumed value, after which the field was switched off. Under these conditions only the normal component of the He II could at first be taken away with the disks, but with its supraliquid component this was possible only after relaxation time. If relaxation time exceeds the time of screwing-out (?), it was obvious that, with a growing distance of the supraliquid component, a considerobvious that,

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able modification of the moment of inertia of the vessel containing the helium (about 25%) was to be expected, which would mean a modification of rotation velocity.
However, the investigation of the damping of the rotating vessel containing the He II showed no noticeable change of velocity, which is illustrated by an attached diagram for the dependence of rotation velocity on time recorded at $T = 1,5^{\circ}$ K for a duration of screwing out (?) of 10, and for 2 seconds. The same tests make it possible to determine the dependence of the inertial moment of He II on rotation velocity. It was found that at velocities of more than 0,5 rotation per second there is no such dependence.
Thus, the lack of the extraction of the supraconductive component on the occasion of experiments with an oscillating stack of disks when small amplitudes are used can by no means be explained by too long a relaxation time. Hitherto, the problem of the dependence of relaxation time on velocity has not yet been solved. The authors' attention was drawn to this fact by L.D.LANDAU.

INSTITUTION: Physical-Technical Institute of the Academy of Science of the Ukrainian SSR.

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

L. AZAREV, B. G.

CARD 1 / 2 PA - 1479

SUBJECT USSR / PHYSICS
AUTHOR GARBER,R.I., GINDIN,I.A., KOGAN,V.S., LAZAREV,B.G.
TITLE The Recrystallization of Metals at Low Temperatures.
PERIODICAL Dokl.Akad.Nauk, 110, fasc.1, 64-66 (1956)
Issued: 11 / 1956 reviewed: 11 / 1956

This work deals with the direct observation of the microstructure of technical iron (0,03% C) and nickel deformed at the temperature of liquid nitrogen. The examination of iron and nickel makes it possible to explain the influence exercised by the principal forms of plastic deformation, namely of twin-formation(?) and creeping on the creation of inhomogeneities of the crystal lattice caused by deformation and on the occasion of processes of recrystallization which are due to these inhomogeneities. Fine- and rough-grained samples with 25-30 μ and 100 - 200 μ diameter were examined. Deformation was brought about either by rolling or by pressing a hardened ball through an immobile thin-walled tube in liquid nitrogen. The degree of deformation was between 5 and 14%. The X-ray structure analysis was carried out: a) in the initial state, b) immediately after the deformation in liquid nitrogen without heating up to room temperatures, c) after a 10 to 12 hours' stay period at room temperature. Parallel with X-ray investigation a metallographical investigation of the samples was carried out. In the case of the iron and nickel deformed in liquid nitrogen the structure was refined by recrystallization after heating up to 20°. A microphotograph of the structure is attached. While the ball is pressed through the tube (in liquid nitrogen) a deformation structure is produced in the sample which is destroyed

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by subsequent heating up to room temperature. A similar structural change is found in iron samples after rolling in liquid nitrogen, but in this case the degree of refinement is higher than on the occasion of pressing the ball through the tube. The degree of refinement in iron and nickel after treatment at low temperatures followed by heating to 20° depends on the size of grain of the initial structure as well as on the degree of deformation. For the production of microdistortions the initial stages of deformation are of importance at low temperatures, on which occasion the work performed by exterior forces goes over nearly entirely into the latent deformation energy. On the occasion of deformation (beginning with an 8% deformation) as a result of pressing a ball through a tube micropores are produced, a process which may be connected with mechanical twin formation. In all the cases of recrystallization at low temperatures investigated on this occasion, deformation was brought about by the formation of creeping stripes either in a pure form (nickel) or in connection with twin formation (iron).

INSTITUTION: Physical-Technical Institute of the Academy of Science in the USSR.

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B. G.

5

A hydrogen condensation pump. B. G. Lazarev, E. S. Borovik, M. F. Fedorova [illegible] Zhur. Tekh. Fiz. [illegible] ZhEF. 7, 175-82 1957 [illegible] plied that gases at 20.4° K. have a rather low vapor pressure, thus, e.g., N will show an equil. pressure of about 10^{-12} mm. Hg. A high vacuum of 10^{-4}-10^{-12} mm. Hg can be obtained by pumping gases over a surface cooled with liquid H, where the condensation rate is high. Two types of pumps were investigated: one has a pumping rate of 13,000 l./sec. with the pumping element inserted into the evacuated space and the other has a pumping rate of about 1000 l./sec.; it was inserted in the vacuum line between the space to be evacuated and the ordinary diffusion pump. Both pumps can be used with the equipment usually employed, e.g. steel vacuum lines and vessels, rubber gasketed flanges, and metal vacuum valves. Werner Jacobson

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Лазарев Б.Г.

BOROVIK, Ye.S.; LAZARYEV, B.G.; TSIN, N.M.

Oil decomposition in diffusion pumps. Ukr.fiz.zhur. 2 no.1: 78-86 Ja-Mr '57. (MLRA 10:5)

1. Fiziko-tekhnichniy institut AN URSR.
(Vacuum pumps)

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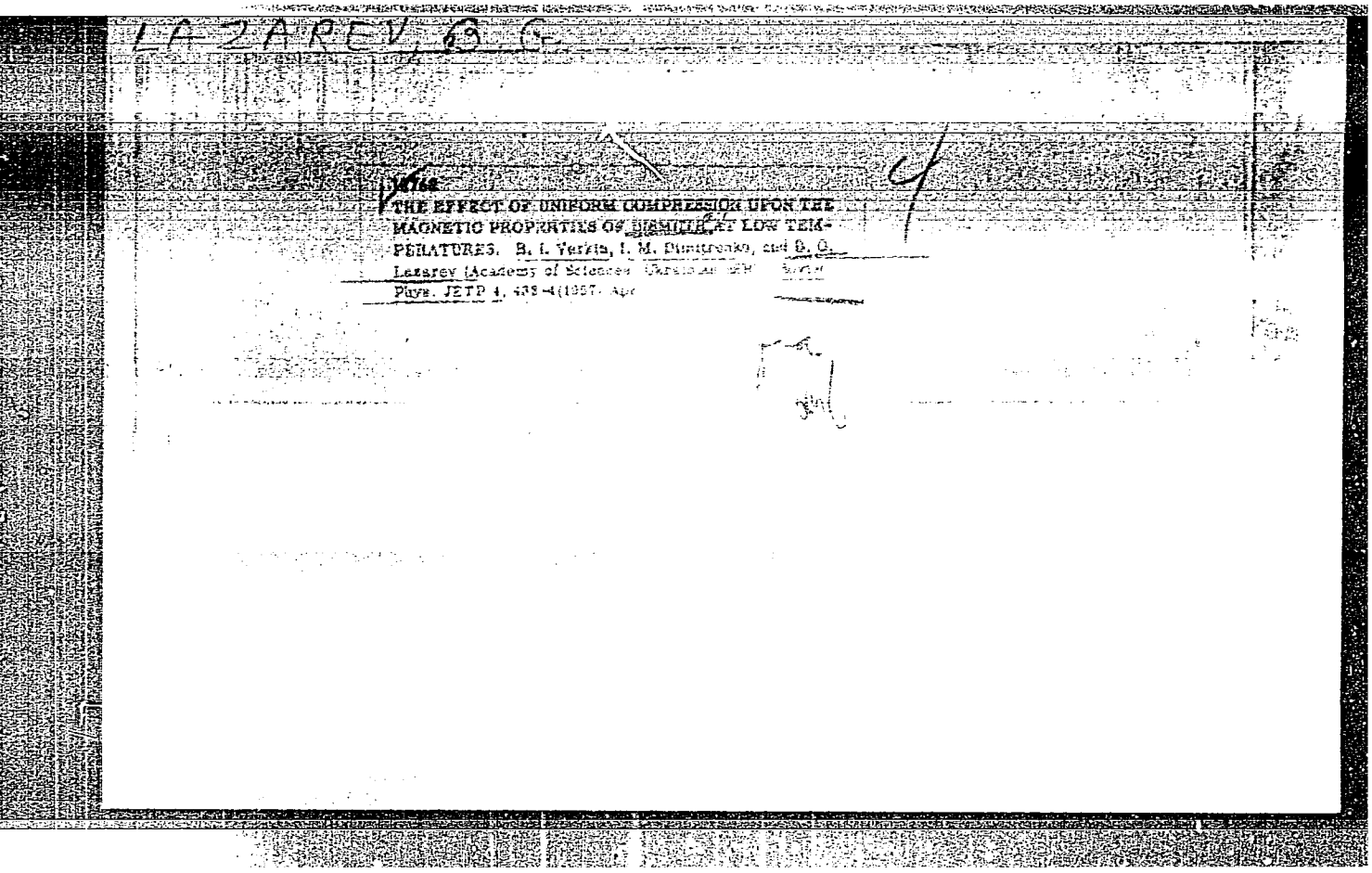

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Yerin

THE EFFECT OF UNIFORM COMPRESSION UPON THE MAGNETIC PROPERTIES OF [illegible] AT LOW TEMPERATURES. B. I. Yerin, I. M. Dmitrenko, and B. G. [illegible]

Lazarev [Academy of Sciences [illegible]

Phys. JETP 4, [illegible] (1957. Apr

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

THE CRYSTALLINE STRUCTURE OF HYDROGEN AND DEUTERIUM. V. S. Kogan, B. G. Lazarev, and R. P. Eulatova (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 593-4(1957) May.

The structure of deuterium was determined to be tetragonal, with a ratio of axes c/a = 0.34 and a parameter a = 6.4 A. Since hydrogen previously was found to have a hexagonal close-packed lattice with parameter a = 3.75A, this previous work was checked and errors are discussed. (M.H.R.)

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

AUTHOR: GALKIN,A.A., KAN,Ya.S., LAZAREV,B.G. 56-6-47/56

TITLE: On the Jump-Like Damping of the Current in a Supraconductive Ring. (O skachkoobraznom zatukhanii toka v sverkhprovodyashchem kol'tse, Russian)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol 32, Nr 6, pp 1582 - 1582 (U.S.S.R.)

ABSTRACT: A thin lead ring located coaxially with a coil is cooled down to the temperature of liquid helium, and in it a current is induced. If the lead ring is evenly heated (10^{-4} to 10^{-5}°/sec) an EMF will be generated in the coil. On this occasion it will be noticed that the current dies down abruptly. These current jumps have aduration of some seconds. In the intervals between jumps the current remains equal. At 4,2°K, $\Delta I/I \approx 10^{-4}$. The effective resistance which corresponds to the damping of the current at the places where the jumps occur, amounts to $\approx 10^{-11}\Omega$. (1 illustrationn and 2 Slavic references)

ASSOCIATION: Physical-Technical Institute of the Ukrainian Academy of Science. (Fisiko-tekhnicheskii institut Akademii nauk U.S.S.R.)

PRESENTED BY:

SUBMITTED: 13.3.1957

AVAILABLE: Library of Congress

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

AUTHORS: Lazarev, B. G., Sudovtsov, A. I., Smirnov, A. P. 56-4-42/54

TITLE: On the Supraconductivity of Beryllium Foils Which Condense on a Cold Underlayer (O sverkhprovodimosti plenok berilliya, skondensirovannykh na kholodnoy podlozhke). (Letter to the Editor)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol. 33, Nr 4, pp. 1059-1060 (USSR)

ABSTRACT: Thin beryllium layers are by vaporizing condensed on the bottom of an evacuateable glass bulb. During the processes of vaporization and condensation the bottom of the glass bulb is dipped into liquid helium. The measurement of the supraconductivity takes place over two electrodes that are melted into the bottom. The thickness of the layer was about 10^{-6} cm. When the thickness increased to more than 10^{-5} cm, the layers came away from the underlayer. Fresh layers show supraconductive properties already at 4,2°K. An accurate determination of the transition point was not yet made, but it is supposed to lie near 8°K.

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On the Supraconductivity of Beryllium Foils Which Condense on a Cold Underlayer 56-4-42/54

There are 2 Slavic references.

ASSOCIATION: Physico-Technical Institute AN Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR.)

SUBMITTED: July 9, 1957

AVAILABLE: Library of Congress

CARD 2/2

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV B.G.

AUTHOR: DMITRENKO, I.M., VERKIN, B.I., LAZAREV, B.G. 56-7-53/66

TITLE: The Influence Exercised by Pressure from all Sides upon the Magnetic Properties of a Zinc Monocrystal at low Temperatures.
(Vliyaniye vsestoronnego szhatiya na magnitnyye svoystva monokristallov tsinka prinizkikh temperaturakh).

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki 1957, Vol 33, Nr 7, pp 287-289 (USSR)

ABSTRACT: At a temperature T = 4,2°K of a magnetic fiwld H = 8400 Oe a self made zinc monocrystal was once exposed to a pressure of P ~ 1500 kg/cm^2 which pressure was then lifted. These conditions prevailing the curves for the angular dependence of the moment L_x, which acts upon the crystal, and the dependence

$\Delta\chi$(1/H) for ϑ 20 and 80° are given.

(With 2 Illustrations and 5 Slavic references)

ASSOCIATION: Physical-Technical Institute of the Ukrainian Academy of Sciences. (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR.)

PRESENTED BY: -

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SOV/137-59-12-26631

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 12, p 124 (USSR)

AUTHORS: Aleksandrov, B.N., Verkin, B.I., Lazarev, B.G.

TITLE: Preparation of Pure Metals by the Method of Multiple Zonal-Recrystallization and the Use of Radioactive Isotopes to Investigate the Mechanism of Purifying the Metal From Admixtures by the Indicated Method

PERIODICAL: Tr. Sessii AS UkrSSR po mirn. ispol'zovaniyu atomn. energii, Kiyev, AS UkrSSR, 1958, pp 119 - 137

ABSTRACT: The authors analyze the methods of metal purifying by recrystallization, and the equipment for multiple zonal melting developed at FTI of AS UkrSSR; they discuss results obtained by investigating the mechanism of the process (distribution of the admixture over the zone, non-stability of the process, and deviations from the equilibrium) with the use of radioactive isotopes (Sn^{113}, Zn^{65}, Ag^{110}, Fe^{59}, In^{114}). It was established that the design of an installation with a ring-shaped crucible, divided by a partition, proved convenient. In this installation the motion of the ingot is performed by the continuous rotation at a required speed of a horizontal disk and the crucible. The authors describe a variant of

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SOV/137-59-12-26631

Preparation of Pure Metals by the Method of Multiple Zonal Recrystallization and the Use of Radioactive Isotopes to Investigate the Mechanism of Purifying the Metal From Admixtures by the Indicated Method

the installation for smelting easily-melted and low-melting substances (the latter with a refrigerator) and of high-melting metals. An installation for zonal melting by electronic bombardment is described. Information is also given on the possible preparation of an ingot with a constant concentration of the admixture over the length, on account of the circulation through the liquid zone of a metal with an initial content of the admixture.

Yu.Sh.

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LAZAREV B.G.

AUTHORS: Kogan, V. S., Lazarev, B. G., Bulatova, R. F. 56-1-42/56

TITLE: On the Phase Diagram of the System Hydrogen - Deuterium (O diagramme sostoyaniya sistemy vodorod-deyteriy)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 1, pp. 238-240 (USSR)

ABSTRACT: At first reference is made to papers dealing with the same subject. In the Congress on Physics of Low Temperatures held in June 1956 in Leningrad reports were also made on the results of investigations of the crystal-structure of the mixtures of hydrogen-isotopes. The solid solutions in such a system only exist in limited domains of concentration. The present paper gives more accurate data on this system which were obtained on the basis of the thermal analysis of the hydrogen-deuterium mixtures. The mixtures produced of pure isotopes were condensed in a calorimeter immersed in liquid hydrogen. After the evacuation the mixture was slowly heated in the temperature interval 14 - 19°C. The thermal analysis showed a horizontal part on the solidus curve at 16,4°K. By a comparison of the data of the thermal analysis with the results of the X-ray photographs at a temperature of 4,2°K the approximate boundaries of the domain of the separation

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in layers could be determined and the phase diagram hydrogen--deuterium in general could be outlined. The existence of the peritectic surface in crystallizations of the mixtures at concentrations of from 26 to 52 per cent by volume of hydrogen was visually verified. In parallel with the thermal analysis the X-ray structure investigations of the hydrogen--deuterium mixtures and of the pure isotopes were continued. A certain perfection of the method of photographing permitted the removal of the parasitic lines. The roentgenograms contain 2 hydrogen-lines which correspond to the distances $d \sim 3{,}15$ Å and $d \sim 2{,}79$ Å between the planes. Of the deuterium-lattice only one line with $d \sim 2{,}94$ Å exists. Due to the high decrease of the intensity of scattering no lines exist under large angles. There exists a concentration range in which the solid mixtures of hydrogen and deuterium are two-phase. The problem of the exact structure of hydrogen and deuterium still remains unsolved. In any case the lattices of hydrogen and deuterium are different. The results obtained here indicate a separation in layers in the solid mixtures of the hydrogen isotopes and correspond to the conclusions drawn by Prigozhin (reference 3) on the existence of a critical temperature, below which the isotope mixtures

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On the Phase Diagram of the System Hydrogen - Deuterium 56-1-42/56

must split up in layers. There are 1 figure and 4 references, 2 of which are Slavic.

ASSOCIATION: Physical-Technical Institute AN Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR)

SUBMITTED: October 5, 1957

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B. G.

AUTHORS: Kan, L. S., Lazarev, B. G. 56-1-53/56

TITLE: The Influence of Universal Compression Upon the Electric Conductivity of Metals at Low Temperatures (Vliyaniye vsestoronnego szhatiya na elektroprovodnost' metallov pri nizkikh temperaturakh)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol.34 Nr 1, pp. 258 - 259 (USSR)

ABSTRACT: At first reference is made to papers dealing with the same subject. The present paper gives some results of the investigation of the influence mentioned in the title. Measurements were made with zinc, tin, gold and bismuth. All samples (with the exception of gold) were produced in the form of monocrystals. The metals used here were highly pure. Bismuth was only investigated, in order to compare the results obtained here with the results obtained by N. Ye. Alekseyevskiy and collaborators (reference 4). According to the authors' measurements, too, pressure in bismuth causes an increase in resistance in the entire temperature range investigated. But the other metals examined here behaved differently. The increase in resistance un-

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56-1-53/56

The Influence of Universal Compression Upon the Electric Conductivity of Metals at Low Temperatures

der pressure at sufficiently low temperatures is common to them. On a temperature increase this increase of the resistance becomes smaller and at a certain temperature (characteristic of every metal) the increase becomes equal to zero. Upon further rise in temperature the effect changes its sign. Numerical data on this effect for zinc, tin and gold are given. In all metals investigated here the authors observed an increase in resistance under the influence of universal compression. This phenomenon is reversible. No explanation for the effect observed could hitherto be given. But the mechanism of this effect is probably different from the mechanism of the influence exerted by pressure upon the electric resistance at high temperatures. Under the influence of pressure similar conditions as in semiconductors are supposed to occur for part of the electrons. There are 7 references, 6 of which are Slavic.

ASSOCIATION: Physical-Technical Institute AN Ukrainian SSR (Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR)

SUBMITTED: October 31, 1957
AVAILABLE: Library of Congress

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

24 (2), 24 (3)

AUTHORS: Dmitrenko, I. M., Verkin, B. I., Lazarev, B. G. SOV/56-35-2-4/60

TITLE: The Magnetic Properties of Metals at Low Temperatures IV (Magnitnyye svoystva metallov pri nizkikh temperaturakh IV). The Influence of Pressure Brought to Bear From All Sides Upon the de Haas-van Alphen Effect in Zinc Crystals (Vliyaniye vsestoronnego szhatiya na effekt de Gaaza-van Al'fena u kristallov tsinka)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 2, pp 328-339 (USSR)

ABSTRACT: The present paper aims at contributing towards facilitating research work concerning the anisotropy of the magnetic properties of crystals at low temperatures. Homogeneous compression of samples (from all sides) was brought about by applying the method developed by Lazarev et al. (Ref 10), i. e. by allowing water to freeze in a bomb. The bomb consisted of pure beryllium bronze (made by I. Bolgov). Experimental conditions: Pressure p 1700 kg/cm^2
Magnetic field H 20 000 Oe

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

The Magnetic Properties of Metals at Low Temperatures IV. The Influence of Pressure Brought to Bear From All Sides Upon the de Haas-van Alphen Effect in Zinc Crystals

SOV/56-35-2-4/60

Temperature Interval 1,6 - 4,2°K

The samples investigated consisted of spectrally pure zinc supplied by the firm of Khil'ger, which was subjected to different kinds of treatment:

Zn-1: prepared according to reference 12, 7 times recrystallized Khil'ger-zinc.

Zn-2, Zn-3, Zn-4: (round) prepared in quartz shell according to Obreimov-Shubnikov; velocity of growth: 10, 15, 50 mm/hour.

Zn-7 (hexagonal) prepared by the method developed by Kapitsa, growth: 5 mm/hour.

First the de-Haas-van Alphen-effect in the free zinc crystals is dealt with. The results obtained are shown by diagrams (Figs 2 - 6) (Angle-dependence of oscillation periods of magnetic susceptibility for the numerically smallest group of mobile charges for two different orientations of the crystal; de Haas-van Alphen-fine-structure effect for 3 different orientations; dependence of the oscillation moment L_z/H^2 on orientation and temperature). The following

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The Magnetic Properties of Metals at Low Temperatures IV. The Influence of Pressure Brought to Bear From All Sides Upon the de Haas-van Alphen Effect in Zinc Crystals

SOV/56-35-2-4/60

investigations were carried out under pressure: The dependence of the period and of the amplitude of the oscillations for the smallest group of mobile charges in the case of different orientation of the crystal. For all θ - values (angle between H and the main axis of the crystal) the periods of these oscillations increase by 40 - 48 %. Homogeneous compression (from all sides) further causes a considerable decrease of the oscillation amplitude as well as a modification of its temperature-dependence. Experimental results are compared with the phenomenological theory of the effects of oscillations in metals. The author thanks A. M. Kosevich for discussing results. There are 7 figures, 3 tables, and 22 references, 15 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute, AS Ukrainskaya SSR)

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"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

1(0)

AUTHORS: Gindin, I. A., Lazarev, B. G., Starodubov, Ya. D., Khotkevich, V. I. SOV/56-35-3-46/61

TITLE: The Low-Temperature Polymorphism of Metals (Nizkotemperaturnyy polimorfizm metallov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 3, pp 802 - 804 (USSR)

ABSTRACT: In the present paper (unlike the practice adopted by several earlier papers dealing with the same subject) the method of mechanical tests is used, in which the compression diagram of lithium, sodium, cesium, bismuth, and beryllium samples with subsequent heating are investigated. Also the variations of volume in inverse transformation are recorded. These tests were carried out on a one-ton machine with a rigid dynamometer, which is suited for carrying out measurements at helium temperatures. The velocity of deformation was constant and amounted to 0,03 mm/sec. A graph gives a typical diagram of the deformation in the coordinates "stress - absolute compression" for lithium. At 77°K this is the melting curve with consolidation of the shape at high degrees of deformation. There are no singular points indicating a

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transformation. If the deformation temperature drops to 20°K and less (down to 1,4°K), a characteristic discontinuity is observed on the curve with a sharp decrease of resistivity against deformation. The most direct proof of the polymorphous transformation in the tests discussed are the variations of volume in inverse transition while the deformed sample is being heated. Similar curves were obtained also for sodium. In the case of cesium no polymorphous transformation is observed on the deformation diagram even at 1,4°K. Nevertheless, the shape of the curve of heating allows us to conclude that, to a small extent, such a transformation actually exists. This behavior of the three alkali metals is apparently connected with the reduction of characteristic temperature and leads to the conclusion that polymorphism exists in the entire group of alkali metals. The discontinuity of stress in the compression diagram is observed also in the case of beryllium at temperatures of 4,2°K and less. All this seems to indicate an extensive occurrence of low-temperature polymorphism, which is observed in the case of tin, sodium, lithium, cesium, bismuth, and beryllium. There are 2 figures and 6 references, 4 of which are Soviet.

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The Low-Temperature Polymorphism of Metals SOV/56-35-3-46/61

ASSOCIATION: Fiziko-teknicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute of the Academy of Sciences, Ukrainskaya SSR)

SUBMITTED: June 7, 1958

Card 3/3

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

LAZAREV, B.G.

Tabelle 2. Vergleichende Werte für einige industrielle Verfahren zur Schwerwassererzeugung

Kenngröße	Wasserrektifikation	Isotopenaustausch Wasserstoff – Wasser in Verbindung mit Elektrolyse	Rektifikation flüssigen Wasserstoffs	Schwefelwasserstoffprozeß in Verbindung mit Wasserrektifikation und -elektrolyse
Elektroenergieverbrauch (kWh) oder Dampfverbrauch (t) je kg D_2O	170 t Dampf [illegible]	70000 kWh	4000–5000 kWh	> 83 t + ≈ 400 kWh
Baukosten, bezogen auf eine Kapazität von 1 t D_2O im Jahr, 1000 Dollar	1100	400	300–330	300
Betriebskosten für 1 kg D_2O (ohne Investitionskosten), Dollar	240	132	33	30
Zeit bis zur Gleichgewichtseinstellung	4–5 Monate	15–16 Monate	20–30 h	–
Extraktion des D_2O, %	2,7	43	90–95	< 10

wasserstoffprozeß bezeichnen. Es besteht aller Grund zu der Annahme, daß die Weiterentwicklung der zur Zeit angewendeten Prozesse sowie die Ausarbeitung neuer Verfahren eine zukünftige Senkung der Selbstkosten für die Schwerwassererzeugung ermöglichen und damit die ökonomischen Kenngrößen der mit Schwerwasser betriebenen Energiereaktoren verbessern.

Eingegangen am 10. 12. 1958

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(Übersetzt von Dipl.-Math. R. Stahl, Berlin, bearbeitet von Dipl.-Phys. G. Wagner, Berlin-Niederschöneweide.)

Eine Wasserstoffkondensationspumpe mit eingebautem Verflüssiger¹)

E. S. Borovik, B. G. Lazarev, I. F. Michailov

Es wird eine Wasserstoffkondensationspumpe mit einer Saugleistung von $2{,}7 \cdot 10^4$ l/s und eingebautem Verflüssiger beschrieben. Die Pumpe erzeugt ein Endvakuum von $\approx 10^{-8}$–10^{-9} Torr. Die gesamte Leistungsaufnahme (unter Berücksichtigung der zur Gewinnung des flüssigen Stickstoffs verbrauchten Leistung) beträgt 17 kW, was weniger als die für Öldiffusionspumpen derselben Sauggeschwindigkeit aufzuwendende Leistung ist.

Bei der Siedetemperatur des Wasserstoffs (20,4 °K) ist der Dampfdruck der meisten Stoffe äußerst gering, so daß eine auf diese Temperatur gekühlte Fläche selbst unter Ultrahochvakuumbedingungen ($p \le 10^{-9}$ Torr) fast alle auf sie treffenden Moleküle kondensiert. Eine Kühlfläche ist das Hauptelement der Wasserstoffkondensationspumpe [1]. Bei hohen Sauggeschwindigkeiten (jeder Quadratzentimeter Kühlfläche gewährleistet eine Förderung von ≈ 11 l/s) erzeugt die Pumpe ein gutes Endvakuum von $\approx 10^{-8}$–10^{-9} Torr.

In den in [1] beschriebenen Konstruktionen erfolgte die Kühlung durch Eingießen von flüssigem Wasserstoff in das Kondensationselement. Trotz großer Einfachheit weist eine derartige Konstruktion auch gewisse Mängel auf: sie kann nur dort betrieben werden, wo flüssiger Wasserstoff zur Verfügung steht, durch Nutzbarmachung der Kälte abgekühlter Wasserstoffdämpfe, die hierbei verlorengeht, wäre es möglich, die Kälteerzeugung der Verflüssigungsanlage um ein mehrfaches zu steigern.

Diese Nachteile kann man vermeiden, wenn man den Wasserstoff unmittelbar an der Pumpe selbst verflüssigt.

¹) E. C. [illegible], B. Г. Лазарев, И. Ф. Михайлов, [illegible], AЭ 7 (1959), H. 2, S. 117.

Read by magazine [illegible] 13 Feb 59

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LAZAREV, B. G.

24(6) PHASE I BOOK EXPLOITATION SOV/2385

Akademiya nauk SSSR

Nekotoryye problemy prochnosti tverdogo tela; sbornik statey (Some Problems in the Strength of Solids; Collection of Articles) Moscow, Izd-vo AN SSSR, 1959. 386 p. Errata slip inserted. 2,000 copies printed.

Ed. of Publishing House: V. I. Aver'yanov; Tech. Ed.: R. S. Pevzner; Editorial Board: A.F. Ioffe, Academician; G. V. Kurdyumov, Academician; S. N. Zhurkov, Corresponding Member, USSR Academy of Sciences; B. P. Konstantinov, Corresponding Member, USSR Academy of Sciences; F. F. Vitman, Doctor of Physical and Mathematical Sciences, Professor (Resp. Ed.); L. A. Glikman, Doctor of Technical Sciences, Professor; N. A. Zlatin, Doctor of Physical and Mathematical Sciences; V. A. Stepanov, Doctor of Technical Sciences; Ya.B. Fridman, Doctor of Technical Sciences, Professor; B. S. Ioffe, Candidate of Technical Sciences (Deputy Resp. Ed.).

PURPOSE: This book is intended for construction engineers, technologists, physicists and other persons interested in the strength of materials.

COVERAGE: This collection of articles was compiled by the Otdeleniye fiziko-matematicheskikh nauk AN SSSR (Department of Physical and Mathematical Sciences) and the Fiziko-tekhnicheskiy institut AN SSSR (Institute of Applied Physics, Academy of Sciences, USSR) in commemoration of the 80th birthday of Nikolay Nikolayevich Davidenkov, Member of the Ukrainian Academy of Sciences, founder and head of the Otdel prochnosti materialov (Department of the Strength of Materials) at the Institute of Applied Physics, Academy of Sciences, USSR, founder of the Fakul'tet fizicheskogo metallovedeniya (Department of Physical Metallurgy) at the Leningradskiy politekhnicheskiy institut (Leningrad Polytechnic Institute), recipient of the Stalin Prize (1943), the Order of the Red Banner of Labor (1945) and the Order of Lenin (1953). The articles deal with the strength of materials, phenomena of imperfect elasticity, temper brittleness, hydrogen embrittlement, cold brittleness, influence of deformation speed on the mechanical properties of materials, fatigue of metals, and general problems of the strength, plasticity, and mechanical properties of nonmetals. Numerous personalities are mentioned in the introductory profile of Professor Davidenkov. References are given at the end of each article.

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24(0)

AUTHOR: Khalatnikov, I. M., Doctor of Physical and Mathematical Sciences

SOV/30-59-2-42/60

TITLE: Investigations of Low-temperature Physics (Issledovaniya po fizike nizkikh temperatur)

PERIODICAL: Vestnik Akademii nauk SSSR, 1959, Nr 2, pp 98-100 (USSR)

LAZAREV, B.G.

ABSTRACT: The 5th All-Union Conference on this problem took place in Tbilisi from October 27 to November 1, 1958. It was attended by physicists from Moscow, Khar'kov, Leningrad, Tbilisi, Sverdlovsk, and Kiyev. 4 fields of low-temperature physics were discussed: superliquidity of liquid helium II, supraconductivity, antiferromagnetism, magneto-resistive effect. The following reports and communications were heard: A. A. Abrikosov, L. P. Gor'kov reported on the investigation of the properties of supraconductive alloys. A. A. Abrikosov, L. P. Gor'kov, I. M. Khalatnikov spoke of properties of supraconductors in the high-frequency magnetic field. D. V. Shirkov and Chen' Chun'-yan' and Chzhou Si-shin', two young Chinese scientists working at Moscow University, described investigations for determination of the influence exercised by the Coulomb (Kulon) interaction of charges on supraconductivity. V. V. Tolmachev explained the nature of the so-called collective excitations of the Bose type in supraconductors. D. N. Zubarev, Yu. A. Tserkovnikov spoke of the thermodynamics of supraconductors and B. T. Geylikman, V. Z. Kresin of the thermal conduction of supraconductors. Yu. V. Sharvin, V. F. Gantmakher reported on experimental work with supraconductors. N. V. Zavaritskiy spoke of the measurement of the anisotropy of thermal conductivity in the supraconductive state. In a series of reports problems of the superliquidity of helium were discussed, which was discovered in 1938 by P. L. Kapitsa and the theory of which was set up in 1941 by L. D. Landau. E. L. Andronikashvili and his collaborators investigated the properties of rotating helium. V. P. Peshkov spoke of the effect of the formation of the boundary between superliquid and non superliquid helium. Guan Vey-yan', collaborator of the Institut fizicheskikh problem (Institute of Physical Problems) investigated the properties of the so-called jump in temperature of Kapitsa. I. M. Lifshits,

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V. D. Peschanskiy investigated galvanomagnetic phenomena in strong magnetic fields for metals with open Fermi surfaces. N. Ye. Alekseyevskiy, Yu. P. Gaydukov experimentally investigated the resistance anisotropy of gold monocrystals in the magnetic field. L. S. Kan, B. G. Lazarev combine the presence of a temperature minimum with the structural state of the metal. M. Ya. Azbel' reported on the quantum theory of metallic conductivity in the alternating electromagnetic and constant magnetic field. A. S. Borovik-Romanov reported on the weak ferromagnetism in antiferromagnetic samples of $MnCO_3$. N. M. Kreynes, Ye. A. Turov investigated the magnetic anisotropy of the antiferromagnetic monocrystals $CuSO_4$ and $CoSO_4$. R. A. Alikhanov reported on neutronographic investigations of antiferromagnetics. Ye. I. Kondorskiy and collaborators reported on the susceptibility of nickel and nickel-copper alloys at low temperatures. M. I. Kaganov, V. M. Tsukernik reported on kinetic phenomena in ferromagnetics at low temperatures. A. I. Akhiyezer, V. G. Bar'yakhtar, and S. P. Peletminskiy spoke of computations of the relaxation of the magnetic moment in ferromagnetic dielectrics at low temperatures. T. I. Sanadze spoke of observation results of paramagnetic resonance of terbium in the $TbNO_3 \cdot 6H_2O$

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nitrate. G. R. Khutsishvili gave a theoretical analysis of the orientation of the nuclear spin in the Overhauser (Overkhauzer) effect in nonmetals. B. N. Samoylov, N. M. Reynov and collaborators reported on obtaining orientated nuclei. R. F. Bulatova, V. S. Kogan and B. G. Lazarev showed that hydrogen isotopes in solid state have different structures. I. A. Gindin, B. G. Lazarev, Kh. D. Starodubov and V. I. Khotkevich detected polymorphism in a number of metals at low temperatures. E. L. Andronikashvili, V. P. Peshkov and M. P. Malkov reported on the stage of development of foreign scientific research work in the field of low-temperature physics. At the end of the Conference P. L. Kapitsa spoke of his successful development of investigations in the field of low-temperature physics. The participants of the Conference visited the Institut fiziki Akademii nauk Gruzinskoy SSR (Physics Institute of the Academy of Sciences of the Gruzinskaya SSR) and the Physics Faculty of Tbilisi University as well as the building of the new research atomic reactor near Tbilisi.

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24(0) SOV/89-7-2-3/24

AUTHORS: Borovik, Ye. S., Lazarev, B. G., Mikhaylov, I. F.

TITLE: A Hydrogen Condensation Pump With a Built-in Liquifier (Vodorodnyy kondensatsionnyy nasos s avtonomnym ozhizhitelem)

PERIODICAL: Atomnaya energiya, 1959, Vol 7, Nr 2, pp 117 - 121 (USSR)

ABSTRACT: Most drawbacks of the pump described in reference 1 are eliminated in the newly developed pump by the fact that the hydrogen is liquified directly in the pump. Two sectional views show the components and the construction of the pump as well as give, to a certain extent, description of the components and their functions. The liquifier is in connection with the compressor (10 m^3/h), but can also be attached to a 17 m^3/h compressor because it has sufficient cooling surface. The operational capacity of the pump was tested with an iron container of $\sim$ 1.5 m^3 content. As the container had a number of flanges and threaded pipe connections, special inside cleaning was impossible and due to this fact a vacuum of only $5 \cdot 10^{-8}$ mm Hg was achieved. The suction rate of the pump was experimentally determined to be $37 \cdot 10^3$ l/sec in the 10^{-7} - 10^{-5} pressure range, and it was also established

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A Hydrogen Condensation Pump With a Built-in Liquifier SOV/89-7-2-3/24

that this rate as independent of the pressure. A separate test established that the pump functions even if there is a considerable formation of gas in the vessel to be evacuated and if there is a considerable amount of dirt on the cooling surface. By inserting a water cooled shutter between the recipient and the pump the suction rate was decreased to 17.10^3 l/sec and even under these conditions at the evaporation of iron for example, a vacuum of $1 - 1.5.10^{-6}$ mm Hg was achieved. There are diagrams showing the dependency of hydrogen consumption in case of strong secondary gas formation and the dependency of the liquifier's capacity on the pressure and the thermal stress respectively. The maximum capacity of the liquifier is $\sim$ 4 l of liquid hydrogen/h at 60 atm. Calculating this data for a 10 m^3/h-compressor, it means 2.5 lit/h. The maximum evaporation of the whole installation is $\sim$ 21/h. The aggregates of the pump consume $\sim$ 13 kw at a pumping efficiency of 37.10^3 l/sec, including the electric energy needed for liquifying the nitrogen in the liquifier. When the energy consumed for producing the nitrogen needed for cooling the main cock is also considered, the total consumption is $\sim$ 17 kw. An oil diffusion pump of the same capacity has a higher energy consumption. B. P. Batrakov and V. I. Sharonov

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participated in carrying out the measurements. There are 6 figures and 2 Soviet references.

SUBMITTED: February 13, 1959

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APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

SOV/126-7-1-17/28

AUTHORS: Lazarev, B.G., Suiovtsov, A.I. and Smirnov, A.P.

TITLE: Plastic Deformation of Iron During the $\gamma \rightarrow \alpha$ Phase Transition (O plasticheskoy deformatsii zheleza pri fazovom $\gamma \rightarrow \alpha$ perekhode)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 1, pp 122-127 (USSR)

ABSTRACT: In a number of papers (Refs.1-4) irreversible changes were detected in the sizes of iron specimens whilst passing through the $\alpha \rightarrow \gamma$ transition temperature range. Lately a paper (Ref.5) has appeared which deals with this particular phenomenon. The authors of the present paper give a few results of their investigation of the residual deformation of iron during transition through the phase change. This phenomenon has been detected dilatometrically. The experiments were carried out with Armco iron, and a few experiments with pure iron(made by the firm Hilger). All measurements were carried out in a vacuum of 10^{-6} -10^{-7} mm Hg. The basic measurements were carried out by means of a simple dilatometer placed in a vacuum (see Fig.1). In

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Plastic Deformation of Iron During the $\gamma \rightarrow \alpha$ Phase Transition

order to check the accuracy of the instruments, dilatometric curves (Fig.2) were plotted at low heating and cooling rates. On plotting the curves under conditions of slow heating and cooling, residual changes in the length of the specimens are not observed. However, a residual change does appear if the experiment is carried out fairly rapidly. It was essential to find which stage of the temperature change is responsible for the phenomenon, heating or cooling. The dilatometric curves in Figs.3 and 4, obtained for a suspended specimen, furnished the answer to this. Both curves were taken on heating (plain circles) and on cooling (points) in the temperature range 800-1000°C. If heating is carried out at any speed and cooling is slow (less than 50°C per minute), the dilatometric curve is reversible (see Fig.3) and no unusual effect appears. Only at a certain cooling rate does the residual elongation of the specimen begin to show (Fig.4). Hence the effect investigated appears in the cooling stage. It is completely absent if the cooling range does not include the transition range of one modification to the other. The effect is repeated

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at each cycle and the overall elongation increases linearly with the number of cycles. Various curves (a, б, в, г, д, е) in Fig.5 have been plotted for various cooling rates (80, 90, 110, 130, 160 and 250°C per minute, respectively). The effect strongly depends on the cooling rate: the angle of inclination of the curves increases with increase in cooling rate. From this curve it can be seen that the effect appears at a cooling rate exceeding 50°C per minute, and increases to saturation. It is possible to assume that it is the difference in the sign of the heat of transformation, and hence the difference in plasticity of the interphase layer, which brings about the difference in deformation of the metal on heating and cooling; i.e. its irreversible dimensional change. This deduction was confirmed by the following experiment. Armco iron plates, 0.1 mm thick, 10 mm wide and 100 mm long were fixed horizontally in groups, and heated in a high vacuum by electric current in such a manner that their centres were in a temperature range exceeding 950°C (i.e. the γ-phase), whilst the ends

 exhibited a temperature gradient, so that the γ- and

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α phases were both present, being divided by a boundary line. The boundary was perpendicular to the plate, and a change in current passed through the specimen caused it to be displaced along the specimen (the zone denoted by a dotted line in Fig.7). As a result of numerous current modulations the plate became shorter and at the same time its width increased in those portions at which the boundaries were displaced. The results of tests with a specimen undergoing compression by its own weight, instead of elongation, gave an effect which was opposite in sign but the same in absolute magnitude. Fig.8 illustrates the behaviour of the suspended specimen (upper curve) and a supported specimen (lower curve). Both curves of this figure were obtained at the same cooling rate, which was 90°C per minute. It appears that the fundamental reasons for this phenomenon are to be found in the volume change and in the heat given out during phase transformation. The actual effect depends very strongly on the experimental conditions, i.e. on the shape of the specimens and the conditions of temperature change.

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Plastic Deformation of Iron During the $\gamma \rightarrow \alpha$ Phase Transition

There are 8 figures and 9 references, of which 4 are Soviet, 2 English, and 3 French.

ASSOCIATION: Fiziko-Tekhnicheskiy institut AN USSR (Physico-Technical Institute, Ac. Sc. Ukr.SSR)

SUBMITTED: December 6, 1957

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APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

SOV/126-7-1-25/28

AUTHORS: Lazarev, B.G., Ovcharenko, O.H. and Khvedchuk, I.R.

TITLE: On the Problem of Determining the Activation Energy of Vacancy-Formation Using Dilatometric Measurements (K voprosu ob opredelenii energii aktivatsii obrazovaniya vakansiy iz dilatometricheskikh izmereniy)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol.7, Nr.1, pp 154-155 (USSR)

ABSTRACT: Gertsriken (Ref.1) pointed out that expansion of a metal on heating is due to an increase in the amplitude of thermal fluctuations as well as to loosening of the lattice by vacancy-formation. The volume change due to vacancy-formation is given by

$$\frac{\Delta V}{V} = Ce^{-E_D/RT},$$

where C is the vacancy density and E_D the energy of formation. The energy E_D found from dilatometric measurements for gold was found to agree well with the value obtained

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On the Problem of Determining the Activation Energy of Vacancy-Formation Using Dilatometric Measurements

from experiments on quenching of vacancies (E_D = 18.2 kcal = = 0.79 eV, Ref.4). This value of E_D indicates a vacancy density of 1.08×10^{-3} near the melting point. It is known that a vacancy density of $(1 - 5) \times 10^{-4}$ can be easily quenched-in in gold. A sample with this quenched-in vacancy density should decrease in volume on cooling. Dilatometric experiments carried out by the authors showed that no such contraction occurred in gold. This negative result is due to the technique employed: the volume contraction was deduced from the change in length of a sample in the form of a plane parallel plate 0.1 mm thick (the other dimensions were 8 and 100 mm). It can easily be shown that contraction of such a sample will occur primarily in the form of a change in the sample thickness rather than its length. There are 4 references, of which 2 are Soviet, 1 German and 1 English.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR
Card 2/3 (Physico-Technical Institute, Ac. Sc. USSR)

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24(2)
AUTHORS: Lazarev, B. G., Ovcharenko, O. N. SOV/56-36-1-10/62

TITLE: The Energy of Formation and Displacement of Vacancies in Gold and Platinum (Energiya obrazovaniya i peremeshcheniya vakansiy v zolote i platine)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 1, pp 60-67 (USSR)

ABSTRACT: In continuation of an earlier paper (Ref 1) in which the authors had investigated the self-diffusion of gold and platinum, the present paper gives a report on the experimental investigation of the formation- and displacement energy of vacancies in thin gold- and platinum wires (with diameters of 0.05 and 0.1 mm). Very pure (99.99 %) tempered metals with a relative electric residual resistance of $3.5.10^{-3}$ (Au), and 2.10^{-3} (Pt) were used (= resistance at 4.5° K/resistance at room temperature). The wires had a length of 50 - 70 mm. Measurements were carried out in temperature intervals of 600 - 1000° C (Au) and 800 - 1500° C (Pt). Resistance measurements at low temperatures were carried out in liquid helium, hydrogen, and nitrogen. Figure 1 shows the dependence of the growth of the relative resistance $\Delta R/R_0$ on temperature

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during quenching of the vacancies (gold) in water and air respectively. The first curve shows an exponential increase of $\Delta R/R_0$ with temperature. In a corresponding manner the dependence $\ln(\Delta R/R_0)$ on $1/T$ (T in $^\circ$ K) develops as a straight line (Fig 2). For the connection between $\Delta R/R_0$ and the vacancy concentration it holds that $\Delta\varrho = (\Delta R/R_0)\varrho = 7.7.10^{-5}\exp(-Q_1/RT)\Omega$ cm, where Q_1 denotes the formation energy of the vacancies. The following was obtained: a) for platinum: $Q_1 = (27.0\pm0.5).10^3$ cal/mole, b) for gold: $Q_1 = (19.0\pm0.5).10^3$ cal/mole.
The second paragraph of the paper deals with the determination of the displacement energy Q_2 of the vacancies, which had already been determined (Ref 1) from the growth of electric resistance in isothermal tempering as amounting to 12.10^3 (Au) and 25.10^3 (Pt). The dependence $\Delta R/\Delta R_0$ on time (0 -30 min) for gold (0.1 mm) at 100° C is shown by figure 3 (straight). Figure 4 shows the same dependence for wires of various thicknesses and various vacancy concentrations for tempering at 120°.

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The Energy of Formation and Displacement of Vacancies SOV/56-36-1-10/62
in Gold and Platinum

The following was obtained:
For Q_2 in platinum: $Q_2 = (25\pm1).10^3$ cal/mole and for gold:
$Q_2 = (20\pm1).10^3$ cal/mole. The sum $Q_1 + Q_2 = Q$ furnishes the activation energy of self-diffusion. For gold one obtains $Q = (0.39\pm1.5).10^3$ cal/mole and for platinum $Q =$
$= (52\pm1).10^3$ cal/mole.
The results are compared with those obtained by other authors. There are 6 figures, 1 table, and 14 references, 3 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk USSR (Physico-Technical Institute of the Academy of Sciences, UkrSSR)

SUBMITTED: August 8, 1958

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APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

24 (7), 24 (2) SOV/56-37-3-15/62

AUTHORS: Kogan, V. S., Lazarev, B. G., Bulatova, R. F.

TITLE: Diffraction of X-Rays in Polycrystalline Samples of Hydrogen Isotopes

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 3 (9), pp 678-683 (USSR)

ABSTRACT: The authors already showed (Ref 1) that the diffraction picture of X-rays on polycrystalline samples of hydrogen, deuterium, and their mixtures depends on the isotope composition of the sample. In this connection the authors believed an investigation of tritium (which is similar to deuterium as regards weight, but to hydrogen with respect to the energy spectrum - half-integral spin -) to be of interest. In figure 1 the experimental arrangement, in which the X-ray pictures of the solid samples of hydrogen isotopes were recorded, are shown and discussed. Figure 2 shows the tritium X-ray picture (copper lines were used as comparison standards) and figure 3 the X-ray pictures of D_2 and H_2. A comparison of the interference patterns indicates the existence of isotopic polymorphism. The difference in the structure of

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hydrogen and deuterium and the similarity of the structure of the latter to that of tritium shows that the polymorphism is not due to a difference in the energy spectra but to a difference in the atomic weight. The observed differences in the structure of hydrogen isotopes are in accordance with the hydrogen-deuterium state diagram investigated in reference 1. A table shows the data obtained concerning the structural parameters of the hydrogen isotopes. Tritium and deuterium have a tetragonal lattice with $c/a = 1.73$ and $a = 3.3$ and 3.35 Å respectively, hydrogen has a tetragonal lattice with $c/a = 0.82$ and $a = 4.5$ Å or a hexagonal lattice with $c/a = 1.73$ and $a = 3.7$ Å. The densities at 4.2° K for tetragonal hydrogen are 0.09 and for hexagonal hydrogen 0.089, for deuterium 0.205, and for tritium 0.324 (for comparison the data obtained by other authors are also given). Figure 6 shows an enlarged X-ray picture of a mixture of hydrogen and deuterium (80 vol% D_2), in which the lines of the solid solution of hydrogen in deuterium are clearly discernible. The results obtained are discussed, and the authors thank M. N. Massalitin for the production of the cryostat used. There are 6 figures, 1 table, and 6 references, 2 of which are Soviet.

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Diffraction of X-Rays in Polycrystalline Samples of Hydrogen Isotopes SOV/56-37-3-15/62

SUBMITTED: April 29, 1959

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APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"

"APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3

B. G. LAZAREV

LAZAREV, B. G.

21(0) SOV/53-67-4-7/7

AUTHOR: Chentsov, R.

TITLE: The Fifth All-Union Conference on the Physics of Low Temperatures (5-ye Vsesoyuznoye soveshchaniye po fizike nizkikh temperatur)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 67, Nr 4, pp 743-750 (USSR)

ABSTRACT: This Conference took place from October 27 to November 1 at Tbilisi; it was organized by the Otdeleniye fiziko-matematicheskikh nauk Akademii nauk SSSR (Department of Physico-mathematical Sciences of the Academy of Sciences, USSR), the Akademiya nauk Gruzinskoy SSR (Academy of Sciences, Gruzinskaya SSR), and the Tbilisskiy gosudarstvennyy universitet im. Stalina (Tbilisi State University imeni Stalin). The Conference was attended by about 300 specialists from Tbilisi, Moscow, Khar'kov, Kiyev, Leningrad, Sverdlovsk, and other cities as well as by a number of young Chinese scientists at present working in the USSR. About 50 lectures were delivered which were divided according to research fields. ...

III. Galvanomagnetic phenomena (10 lectures). I. M. Lifshits and V. D. Peschanskiy (KhFTI, Khar'kov Physico-technical Institute, Khar'kov University) showed that the most important part in connection with the galvanomagnetic properties of metals is played by the concrete form of the Fermi surface of conductivity electrons. N. Ye. Alekseyevskiy (IFP) spoke about experiments he carried out together with Yu. P. Gaydukov. He investigated the variation of the resistance in the transversal magnetic field at helium temperatures of Au, Cu, Pb, Ta, Ga, Ti and (together with T. I. Kostina) of Bi. Ye. S. Borovik and V. G. Volotskaya (KhFTI) investigated the galvanomagnetic properties at low temperatures of chromium and zirconium and found that the resistance of chromium grows with field strength without attaining a saturation value. L. S. Kan and B. G. Lazarev (KhFTI) investigated the resistance minimum in gold at low temperatures and found that if the sample is heated, the minimum disappears. Yu. P. Gaydukov (IFP) said in this connection in the course of the discussion that the minimum effect does not occur in gold in the case of very pure samples; the disappearance of the minimum is explained by the plastic deformation of the sample at helium temperatures. M. Ya. Azbel'

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(KhFTI) gave a report of his work in connection with the quantum theory of the high-frequency resistance of metal in a constant magnetic field at low temperatures. M. I. Kaganov and V. M. Tsukernik (KhFTI) spoke about a theoretical investigation of the influence exercised by thermoelectric forces upon the skin effect in various conductors. B. I. Verkin and B. N. Aleksandrov (KhFTI) spoke about measurements of the electric resistance of thin wires made from highly-pure tin, indium and cadmium, and computed the free length of path at 4.2°K in these metals as amounting to 1/3 to 2/3 mm. N. B. Brandt (MGU) and B. I. Verkin and I. M. Dmitrenko (KhFTI) investigated the influence exercised by the hydrostatic pressure (of 1000 atmospheres absolute pressure) upon the behavior of metals at low temperatures and investigated the quantum oscillations of the magnetic susceptibility of bismuth at 1.6 - 4.2°K. G. Ye. Zil'berman and A. M. Kosevich (KhFTI) gave a theoretical explanation of the fact that already relatively small deformations exercise considerable influence upon oscillation effects in metals. IV. Magnetism. A. S. Borovik-Romanov (IFP) delivered a report on investigations he carried out of the anisotropy of the weak ferromagnetism in monocrystal samples of the antiferromagnetic

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$MnCO_3$ (the effect of anisotropy was predicted by the thermodynamical theory developed by Dzyaloshinskiy). In the course of the discussion R. A. Alikhanov (IFP) spoke about neutronographical investigations he carried out of the magnetic structure of $MnCO_3$ and $FeCO_3$ at low temperatures. P. L. Kapitsa stressed the importance of the method based upon Dzyaloshinskiy's theory. N. M. Kreynes (VNIIFTRI), whose lecture was read by A. S. Borovik-Romanov, reported on measurements carried out by him (in the IFP) of the magnetic anisotropy of the antiferromagnetic $CuSO_4$- and $CoSO_4$-monocrystals.

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Ye. A. Turov (IFM AN SSSR, Sverdlovsk) spoke about his theore-

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B. G. LAZAREV

24(0) SOV/53-67-4-7/7

AUTHOR: Chentsov, R.

TITLE: The Fifth All-Union Conference on the Physics of Low Temperatures (5-ye Vsesoyuznoye soveshchaniye po fizike nizkikh temperatur)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 67, Nr 4, pp 743-750 (USSR)

ABSTRACT: This Conference took place from October 27 to November 1 at Tbilisi; it was organized by the Otdeleniye fiziko-matematicheskikh nauk Akademii nauk SSSR (Department of Physico-mathematical Sciences of the Academy of Sciences, USSR), the Akademiya nauk Gruzinskoy SSR (Academy of Sciences, Gruzinskaya SSR), and the Tbilisskiy gosudarstvennyy universitet im. Stalina (Tbilisi State University imeni Stalin). The Conference was attended by about 300 specialists from Tbilisi, Moscow, Khar'kov, Kiyev, Leningrad, Sverdlovsk, and other cities as well as by a number of young Chinese scientists at present working in the USSR. About 50 lectures were delivered which were divided according to research fields.

. . . . V. Various Questions.

One of the most interesting lectures delivered at this Conference was that by I. A. Gindin, B. G. Lazarev, Ya. D. Starodubov and V. I. Khotkevich (KhPTI) on the polymorphism of metals at low temperatures; P. L. Kapitsa commented on this topic during the discussion. R. F. Bulatova, V. S. Kogan and B. G. Lazarev (KhPTI) investigated the system hydrogen-deuterium by the methods of low-temperature-radiography, thermal analysis, and the visual observation of crystallization. Kh. I. Amirkhanov, Sh. Kh. Amirkhanova and R. I. Bashirov investigated the thermomagnetic properties of compounds of the type $A^{III}B^{V}$ and $A^{II}B^{VI}$, and dealt with the phenomenon of the "photon

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wind" predicted by Gurevich; the investigation was carried out at the Dagestanskiy filial AN SSSR (Dagestan Branch, AS USSR). N. M. Reynov and A. P. Smirnov (LPTI - Leningrad Physico-technical Institute) gave a report on the measurement of the electricity limit of tin- and indium polycrystals at very low temperatures (1°K), and N. M. Reynov and N. I. Krivko (LPTI) spoke about attempts made to find the expected diamagnetic resonance on polarons in cuprous oxide. G. R. Khutsishvili (TGU & Institut fiziki AN Gruzinskoy SSR - Tbilisi State University and Institute of Physics AS Gruzinskaya SSR) carried out a theoretical investigation of the Overhauser effect in non-metals. Lomkadze investigated the electron- and nuclear (proton) resonance in diphenylpicryl hydracyl at helium temperature. B. N. Samoylov spoke about experiments he carried out concerning the orientation of Co^{60}- and Au^{198}-nuclei (in iron) at extremely low temperatures. B. P. Zakharchenya and Ye. F. Gross (LPTI) investigated the absorption spectrum of a cuprous oxide crystal in the magnetic field at helium temperature and observed the effect of magneto-optical oscillations. V. P. Peshkov and M. P. Malkov gave information concerning scientific work of Soviet scientists in foreign countries (zagranichnaya nauchnaya komandirovka), and E. V. Shpol'skiy spoke about the abstracting journal "Fizika". The head of the department for problems of the physics of low temperatures, Academician P. L. Kapitsa and the President of the Academy of Sciences Gruzinskaya SSR, Academician N. I. Muskhelishvili closed the Conference. The 6. All-Union Conference on the Physics of Low Temperatures will be held in June and July 1959 in the city of Sverdlovsk.

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APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000928910018-3"